UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF PENNSYLVANIA

JILL STEIN, RANDALL REITZ, ROBIN HOWE,
SHANNON KNIGHT, and EMILY COOK,

                Plaintiffs,

   -against-

KATHY BOOCKVAR, in her official capacity as
Acting Secretary of the Commonwealth; and
JONATHAN MARKS, in his official capacity as
Commissioner of the Bureau of Commissions,
Elections, and Legislation,

                Defendants.

No. 16-CV-6287 (PD)

**DECLARATION OF ILANN M. MAAZEL IN SUPPORT OF
PLAINTIFFS' MOTION TO ENFORCE SETTLEMENT AGREEMENT**

      ILANN M. MAAZEL declares, under penalty of perjury, pursuant to 28 U.S.C.

§ 1746, that the following is true and correct:

      1.   I am a partner in the firm of Emery Celli Brinckerhoff & Abady LLP, counsel for

Plaintiffs in this matter. I am admitted *pro hac vice* in this action. I submit this declaration in

support of Plaintiffs' motion to enforce the settlement agreement.

      2.   Attached as Exhibit A is a copy of the settlement agreement in this case.

      3.   Attached as Exhibit B is a copy of Pennsylvania's Report Concerning the

Reexamination of Election Systems and Software ExpressVote XL, issued by Kathy Boockvar

on September 3, 2019, downloaded at my direction from https://www.dos.pa.gov

/VotingElections/Documents/Voting%20Systems/ESS%20EVS%206021/Reexamination%20Re

sults%20(ExpressVote%20XL)%2009-03-2019.pdf.

4.   Attached as Exhibit C is a copy of Plaintiffs' first letter to Defendants regarding noncompliance with the Settlement Agreement, dated July 29, 2019.

5.   Attached as Exhibit D is a copy of Defendants' response to Plaintiffs' first letter concerning noncompliance with the Settlement Agreement, dated September 12, 2019.

6.   Attached as Exhibit E is a copy of Plaintiffs' second letter to Defendants concerning noncompliance with the Settlement Agreement, dated October 1, 2019.

7.   Attached as Exhibit F is Defendants' response to Plaintiffs' second letter concerning noncompliance with the Settlement Agreement, dated October 30, 2019.

8.   Attached as Exhibit G is a copy of a statement by Amy Hess, Acting Registrar of the Northampton County Election Office, dated November 6, 2019, downloaded at my direction from https://www.northamptoncounty.org/CTYEXEC/Documents/110519%20PR%20Election%20Results.pdf.

9.   Attached as Exhibit H is a copy of an article by Emily Opilo and Tom Shortell titled "Northampton County to rescan ballots after GOP chair calls for recount: 'We have a hanging chad moment'" from *The Morning Call* dated November 6, 2019, downloaded at my direction from https://www.mcall.com/news/elections/mc-nws-election-voting-machine-results-confusion-20191106-b7syviya35efxassqhntfdyai4-story.html.

10.   Attached as Exhibit I is a copy of an article by Kartikay Mehrotra and Margaret Newkirk titled "Expensive Glitchy Voting Machines Expose 2020 Hacking Risks: Paper ballots may be safer and cheaper, but local officials swoon at digital equipment" from *Bloomberg* dated November 8, 2019, downloaded at my direction from https://www.bloomberg.com/news/articles/2019-11-08/expensive-glitchy-voting-machines-expose-2020-hacking-risks.

11.   Attached as Exhibit J is a copy of an e-mail exchange among counsel dated November 8, 2019.

12.   Attached as Exhibit K is a true and correct copy of a News Release from the State of Colorado, titled "Colorado Secretary of State Takes Action to Increase Cyber Security, Announces Initiative to Remove QR codes from Ballots" dated September 16, 2019, downloaded at my direction from https://www.sos.state.co.us/pubs/newsRoom/pressReleases/2019 /PR20190916QRCodes.html.

13.   Attached as Exhibit L is a true and correct copy of definitions from the National Institute of Standards and Technology, downloaded at my direction from https://pages.nist.gov/ElectionGlossary/.

14.   Attached as Exhibit M is a true and correct copy of Pennsylvania's Report Concerning the Examination Results of Clearballot Clearvote 1.5 with Clearcast Precinct Scanner, Clearcount Central Scanning Solution, Clearaccess Ballot Marking Device and Cleardesign Election Management System, issued by Kathy Boockvar on March 22, 2019, downloaded at my direction from https://www.dos.pa.gov/VotingElections/Documents /Voting%20Systems/ClearBallot/ClearVote%201.5%20Secretarys%20certification%20report%2 0Final%20-%20with%20signature.pdf.

Dated: November 25, 2019
        New York, New York

                                        _____/s/_____
                                        ILANN M. MAAZEL

Exhibit A

UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF PENNSYLVANIA

JILL STEIN, RANDALL REITZ, ROBIN HOWE,
SHANNON KNIGHT, EMILY COOK, and
KIMBERLY KUPKA,

           Plaintiffs,

                                        No. 16-CV-6287

  v.

PEDRO A. CORTÉS, in his official capacity as
Secretary of the Commonwealth; and JONATHAN
MARKS, in his official capacity as Commissioner
of the Bureau of Commissions, Elections, and
Legislation,

           Defendants.

SETTLEMENT AGREEMENT AND RELEASE

I.   INTRODUCTION

    1.   This private settlement agreement and release (the "Agreement") is entered into as of the date of the last signatory ("Effective Date"), among the plaintiffs, Jill Stein, Randall Reitz, Robin Howe, Shannon Knight, and Emily Cook;[1] and defendants Robert Torres, in his official capacity as Acting Secretary of the Commonwealth,[2] and Jonathan Marks, in his official capacity as Commissioner of the Bureau of Commissions, Elections and Legislation.

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[1] Plaintiff Kimberly Kupka withdrew from this action by the filing of a Notice of Withdrawal with this Honorable Court on August 29, 2018.

[2] Defendant Pedro A. Cortes resigned the position of Secretary of the Commonwealth on October 10, 2017; Robert Torres was designated to serve as Acting Secretary of the Commonwealth on the same day.

II.   VOTER-VERIFIABLE PAPER BALLOTS FOR EVERY VOTER

2.   The Secretary will only certify new voting systems for use in Pennsylvania if they meet these criteria:

a.   The ballot on which each vote is recorded is paper[3];

b.   They produce a voter-verifiable record of each vote; and

c.   They are capable of supporting a robust pre-certification auditing process.

3.   The Secretary will continue to direct each county in Pennsylvania to implement these voting systems by the 2020 primaries, so that every Pennsylvania voter in 2020 uses a voter-verifiable paper ballot.

4.   To ensure that new voting systems meet the criteria set forth in Paragraphs #2-3, and to work collaboratively to further the parties' shared goal of promoting reliable and secure voting in Pennsylvania, a designee of Plaintiffs will be invited to observe the certification process. To that end:

a.   The Secretary shall ensure that the Plaintiffs are made aware of all currently scheduled, and future scheduled, Commonwealth on-site certification testing for Voting Systems;

b.   Plaintiffs will appoint a person to attend any and/or all on-site certification testing undertaken by or on behalf of the Secretary, and the representative may provide written or oral comments to the Secretary concerning the certification of any Voting Systems at breaks during the on-site certification testing or within a reasonable period after completion of the on-site testing; and

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[3] A VVPAT receipt generated by a DRE machine is not a paper ballot.

    c. To the extent there are periods during the on-site testing when proprietary information must be discussed among the vendor, the contracted testing examiner(s) and the Department of State, Plaintiffs' representative will be excused from the testing room.

III.   ROBUST PRE-CERTIFICATION AUDITING

5.   The Secretary will direct each county to audit all unofficial election results using robust pre-certification audit methods to be determined based on the recommendations of a Work Group established by the Secretary, consistent with applicable statutory authority and the following principles:

    a. Pre-certification. Audits must be completed before the election results are certified.

    b. Automatic. Audits must happen automatically, without a request from voters or candidates.

    c. Best Practices. Audits shall be conducted consistent with best practices in the field.

    d. Escalation. If the initial audit fails to rule out a possible outcome-altering error with the requisite level of confidence, additional measures must be undertaken to ensure that there are no outcome-altering errors in the vote.

6.   The Work Group shall be formed by January 1, 2019, and shall complete its written report by January 1, 2020.

7.   Plaintiffs shall have the right to designate up to ten percent (10%) of the members of the Work Group, and at a minimum one person.

8.   The Secretary shall direct that pilot auditing occur in 2021, and that auditing be fully implemented by the 2022 general election.

IV.   ATTORNEYS' FEES

9.   Defendants will pay to Plaintiffs $150,000.00 (One Hundred Fifty Thousand Dollars) in reasonable attorneys' fees and costs incurred in litigating this action through the execution of the agreement. Said payment is a complete settlement of all fees and costs, and encompasses all fees and costs related to Plaintiffs' and their agents' participation in the process of certification of voting machines as delineated in this agreement, as well as Plaintiffs' and their agents' participation in the Work Group delineated in this agreement. Said payment will be paid by means of one check made payable to the law firm of "Emery Celli Brinckerhoff & Abady LLP, as attorney." Defendants will submit the appropriate paperwork for issuance of the check to the Pennsylvania Bureau of Risk Insurance Management no later than 30 days after full execution of this Agreement.

V.   ENFORCEMENT

10.   The parties agree that this Agreement between the parties must be considered a private settlement agreement, does not require court approval, and that the parties are not seeking Court approval.

11.   The parties agree that this Agreement may not be construed by either Party as a Consent Decree, nor shall any Party argue before any Court of competent jurisdiction, federal or state, that this Agreement is a Consent Decree.

12.   Should any Court determine during the term of the private settlement agreement that this Agreement is a Consent Decree, then the private agreement is voided and the parties agree that a petition to reopen the case may be filed.

13.   The Court shall retain jurisdiction to enforce the terms of this private Settlement Agreement. The parties agree to request the Court to enter an Order dismissing this case, but retaining jurisdiction solely to enforce the terms of this private Settlement Agreement.

14.   Prior to seeking specific performance from the Court, if Plaintiffs have a reasonable basis to believe that Defendants are in non-compliance with a material term of this Agreement, Plaintiffs will notify the Defendants in writing of the specific compliance issue(s). This notice shall identify with particularity the basis of the claim that the Defendants are not in compliance and the specific provisions of this Agreement that are implicated.

15.   Within thirty (30) days of receipt of the notification, the Defendants will provide a good-faith written response to the Plaintiffs' notification with a full factual explanation: (a) as to why the Defendants believe they are in compliance with the Agreement; or (b) of possible non-compliance and a statement of the Defendants' plans to ensure full compliance.

VI.   NOTICE

16.   All notices required under this Agreement will be sent via electronic mail and overnight mail or overnight courier to the following people:

If to the Plaintiffs:

Emery Celli Brinckerhoff & Abady LLP
c/o Ilann M. Maazel
600 Fifth Avenue, 10th Floor
New York, NY 10020
imaazel@ecbalaw.com

If to the Defendants:

Department of State
c/o Timothy E. Gates
Office of Chief Counsel
306 North Office Building
401 North Street
Harrisburg, PA 17120-0500

tgates@pa.gov

VII. RELEASE AND DISCHARGE

17.   In consideration of the terms and conditions called for herein, the Plaintiffs

release and completely and forever discharge the Defendants, the Department of State, the

Secretary of the Commonwealth, and the Commonwealth of Pennsylvania, their agents,

attorneys, servants, representatives, and employees, past and present, and their past, present and

future agents, attorneys, servants, representatives, and employees and all other persons with

whom any of the former have been, are now or may hereinafter be affiliated, of and from any and

all past or present claims, demands, obligations, actions, causes of action, rights, damages, costs,

expenses, and any claims for compensation or punitive or other damages of any type which

relates to the subject matter of this civil action. This release shall not prevent Plaintiffs from

seeking court enforcement of the Agreement.

18.   Plaintiffs expressly waive any and all claims which relate to the subject matter of

this civil action, but of which the Plaintiffs do not know or suspect to exist, whether through

ignorance, oversight, error, negligence or otherwise, and which if known would materially affect

the Plaintiffs' decision to execute this Agreement.

19.   All parties acknowledge that they have had the opportunity to consult with

counsel, and further acknowledge that they fully understand and agree to the terms of this

Agreement.

VIII. NO ADMISSION

20.   It is understood and agreed that this settlement is a compromise of highly disputed

claims, entered into to avoid further litigation. Nothing contained herein shall constitute or be

construed to constitute an admission by any part of the merits of claims or defenses which were,

or which might have been, asserted by an opposing party in the course of litigating the captioned action. Nor shall anything contained herein constitute or be construed to constitute a concession by any party that it would not have prevailed on claims or defenses which were, or which might have been, asserted by it in the course of litigating the captioned action. The settlement has no precedential value and may not be cited or relied upon by any person in any proceeding for any purpose. It is not to be construed as an admission of liability on the part of any party being released hereunder, any such liability being expressly denied.

IX.   MISCELLANEOUS PROVISIONS

21.   Plaintiffs represent and warrant that besides themselves, no other person or entity has or has any interest in the claims referred to in this Agreement, except as otherwise set forth herein; and that they have the sole right and exclusive authority to execute this Agreement.

22.   This Agreement contains the entire agreement between the parties with regard to the matters set forth herein and supersedes any and all prior agreements between the parties relating to all or part of the subject matter of this Agreement, and shall be binding upon and inure to the benefit of the successors and assigns of each from the Effective Date of this Agreement until December 31, 2022 (Expiration Date).

23.   This Agreement shall be construed and interpreted according to the law of the Commonwealth of Pennsylvania.

24.   If, subsequent to the Effective Date of this Agreement, any provision or term of this agreement is held to be invalid, illegal, unenforceable or in conflict with the law in any jurisdiction, the validity and legality of the remaining provisions will not be affected or impaired thereby.

25.   Any headings or subheadings used herein are for reference purposes only and do not affect the substantive provisions of the Agreement.

26.   This Agreement may be executed in counterparts, and a facsimile or .pdf signature shall be deemed to be, and have the same force and effect as, an original signature.

X.   STIPULATION OF DISMISSAL

27.   The parties agree that they will sign and submit a stipulation of dismissal with prejudice pursuant to Fed.R.Civ.P 41(a)(1)(A)(ii) to the Court at the expiration of this Agreement.

Counsel for Plaintiffs:

Counsel for Defendants:

_____
Ilann M. Maazel, Esq.
Douglas E. Lieb, Esq.
Emery Celli Brinckerhoff & Abady LLP
600 Fifth Avenue, 10th Floor
New York, NY 10020
(212) 763-5000

Date: November __, 2018

_____
Sue Ann Unger, Esq.
Senior Deputy Attorney General
Stephen Kovatis, Esq.
Senior Deputy Attorney General
1600 Arch Street, Suite 300
Philadelphia, PA 19103
(215) 560-2127

Date: November __, 2018

_____
John G. Papianou, Esq.
Montgomery McCracken Walker & Rhoads
1735 Market Street
Philadelphia, PA 19103
(215) 772-7389

Date: November __, 2018

_____
Timothy Gates, Esq.
Chief Counsel
Kathleen Kotula, Esq.
Executive Deputy Chief Counsel
Pennsylvania Department of State
306 North Office building
401 North Street
Harrisburg, PA 17120
(717) 783-0736

Date: November 28, 2018

Page 8 of 8

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Date: November __, 2018

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1735 Market Street
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Senior Deputy Attorney General
Stephen Kovatis, Esq.
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Timothy Gates, Esq.
Chief Counsel
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306 North Office building
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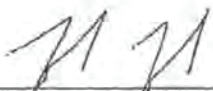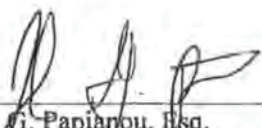(717) 783-0736

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Counsel for Plaintiffs:

Ilann M. Maazel, Esq.
Douglas E. Lieb, Esq.
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600 Fifth Avenue, 10th Floor
New York, NY 10020
(212) 763-5000

Date: November 28 2018

John G. Papianou, Esq.
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Date: November 28, 2018

Counsel for Defendants:

Sue Ann Unger, Esq.
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(717) 783-0736

Date: November ___, 2018

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Exhibit B

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF STATE

REPORT CONCERNING THE REEXAMINATION RESULTS OF ELECTIONS SYSTEMS AND SOFTWARE EXPRESSVOTE XL

Issued By:

Kathy Boockvar
Acting Secretary of the Commonwealth
September 3, 2019

REEXAMINATION RESULTS OF ELECTION SYSTEMS AND SOFTWARE EXPRESSVOTE XL

I. INTRODUCTION

Article XI-A of the Pennsylvania Election Code, 25 P.S. §§ 3031.1 *et seq.* (the "Code"), authorizes the use of electronic voting systems. Section 1105-A of the Code, 25 P.S. § 3031.5(a), allows any ten or more qualified electors of Pennsylvania to request a reexamination of an electronic voting system certified by the Secretary of the Commonwealth ("Secretary"). On July 17, 2019, the Acting Secretary of the Commonwealth ("Acting Secretary") received a Petition to Reexamine the ExpressVote XL (the "Petition"). A copy of that Petition is attached hereto as Appendix A.

The ExpressVote XL was initially examined and certified as part of the ES&S EVS 6021 electronic voting system to both federal and state voting system standards by the Election Assistance Commission ("EAC") on November 12, 2018 and by the Secretary of the Commonwealth on November 30, 2018.

The Petition sets forth ten claims for why the Acting Secretary should de-certify the ExpressVote XL (XL). After a thorough and considered review of the Petition, the Acting Secretary has determined that claims three through seven, nine, and ten amount to purely legal arguments which do not apply to reexamination or certification of an electronic voting system. With respect to claims one, two, and eight, the Acting Secretary, in consultation with the Department of State's expert voting system examiner, reexamined the XL and concluded that the XL meets the requirements of Section 1107-A of the Pennsylvania Election Code, 25 P.S. § 3031.7, and can be safely used to conduct elections in the Commonwealth.

To satisfy the Secretary's statutory obligation to reexamine the XL system based on claims one, two, and eight in the Petition, the Pennsylvania Department of State ("Department") entered into an agreement with expert professional consultant SLI Compliance ("SLI") to conduct a focused reexamination of the XL. Jesse Peterson, Security Specialist, and Mike Santos, Senior Test Manager, served as the examiners ("Examiners").

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The off-site reexamination was conducted at the laboratory of SLI Compliance located in Wheat Ridge, Colorado. The Department was represented by Sindhu Ramachandran, Voting System Analyst, for the reexamination on August 7 and 8, 2019. The Examiners then provided findings from the examination, and the test results and conclusion have been included in further sections of this report.

II.   THE EXPRESSVOTE XL VOTING SYSTEM

ExpressVote XL

ExpressVote XL is a polling place voting device that provides touch screen vote capture which incorporates printing of a voter's selections as a paper voter-verifiable record and tabulation scanning into a single unit. The system uses a touch-operated screen and/or assistive technology to capture a voter's choices. The integrated thermal printer prints the voter's choices on a voter-verifiable paper vote summary record and the system scans and saves an image of the printed vote summary record. The vote summary record is the voter-verifiable paper record with plain text words of the votes to be cast, which, once cast, will be retained as the official vote record and used for audits and/or recounts.

The software/firmware version of ExpressVote XL certified as part of the EVS 6021 system is 1.0.1.0 and the hardware version is 1.0.

Test Materials

Test support materials utilized during the examination included:

- Two ExpressVote XL devices
- CFAST cards for both ExpressVote XL devices
- Thermal receipt paper for the Expressvote XL
- Activation card stock for processing vote summary records on the ExpressVote XL
- CFAST Cards
- USB thumb drives

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- Pens to modify marks

III.   REEXAMINATION APPROACH

A.   Approach Summary

The reexamination focused on the alleged violations of Sections 1107-A(1) and (12) of the Pennsylvania Election Code, 25 P.S. §§ 3031.7(1) & (12), relating to vote record secrecy and security, set forth in items one, two, and eight of the petition. The Examiner evaluated the petition and relevant system documentation to develop test protocols for the examination. All hardware necessary to perform the reexamination was supplied by ES&S. Software and firmware for the EVS 6021 voting system was obtained from the Voting System Test Lab ("VSTL") that performed the EAC certification test campaign. The Examiner installed the firmware using the appropriate media and process for installation.

The test protocols separated the requirements for the reexamination into three main areas of test execution: (1) Security Analysis and Evaluation; (2) Functional Testing; and (3) Documentation Review.

1. Security Analysis and Evaluation

The Examiners performed security analysis of the XL, with special consideration to the items set forth in the Petition. The Examiners' security specialist reviewed the system to evaluate the system's security protocols. In order to gather details for the functional test execution, SLI included a review of internal security, functional and architectural diagrams, software specification, as well as ExpressVote XL hardware schematic documentation. The analysis was done to reexamine the system architecture and operations and to plan a comprehensive approach to analyze and evaluate each allegation. The Examiners also utilized the vulnerability assessment performed during the initial examination of the EVS

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6021 voting system. This evaluation was used during test planning to identify the specific test cases to be executed during the functional testing and documentation review phases.

2. Functional Testing

The functional testing phase involved SLI personnel executing test cases identified during the security analysis and evaluation. This phase provided a means to assess the security and functional properties of the voting system under examination to ascertain whether they provide acceptable security procedures to prevent tampering with or substitution of vote summary records, as required by the Pennsylvania Election Code at 25 P.S. § 3031.7(12). The Examiner also used the functional testing to evaluate compliance of the system to the Pennsylvania Election Code requirement at 25 P.S.§ 3031.7(1) to ascertain whether the system provides for processes and procedures to maintain the secrecy of a voter's ballot.

3. Documentation Review

The documentation review phase consisted of reviewing the ES&S EVS 6021 voting system documentation to verify that appropriate processes and procedures are in place to provide acceptable security and privacy as required by 25 P.S.§§ 3031.7(1) and (12).

IV.   Examination Results and Discussion

A.   Examination Results and Discussion regarding Allegation #1

The Petition's allegation number one alleges that the XL violates Section 1107-A(12) of the Pennsylvania Election Code, 25 P.S. § 3031.7(12), which requires that a voting system "provides acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards," because it does not provide acceptable procedures to prevent tampering.

As detailed below, The Examiner evaluated these claims and determined through security analysis and evaluation, functional testing, and documentation review that the XL **does not** violate Section 1107-A(12) of the Pennsylvania Election Code because it has

protocols and mechanisms to provide for acceptable security procedures to prevent tampering with or substitution of the vote summary records. The results of the Examiner's documentation review and testing are summarized in the following paragraphs of this section.

1.   Security Analysis and Evaluation

The security specialist reviewed the internal security, functional and architectural diagrams, software specifications, as well as the XL hardware schematic documentation. The Examiners also utilized the vulnerability assessment performed during the initial examination of the EVS 6021 voting system. The Examiners gathered information about the system security protocols in place to prevent undetectable malicious manipulation of the XL, as well as information about the programmatic and physical access controls in place to prevent tampering. The Examiners then used the information gathered during this evaluation to identify specific test cases to be executed during the functional testing and documentation review phases.

2.   Functional Testing

The XL was set up following all the physical security measures described in the relevant system documentation. The Examiners reviewed and tested each of the physical security measures in place, which demonstrated that different system access points and the CFAST cards could not be reached without proper keys and tools. The Examiners then performed a hash code validation successfully, confirming that the installed image matched the certified image.

The Examiners installed the trusted build and loaded a test general election on the XL devices used for the testing effort. The security specialist tried to penetrate the system using the system access points/ports and was unsuccessful. The Examiner also performed a hash code validation on the XL after the tests to confirm that the trusted build firmware was still present on the device. The Examiners confirmed that any modifications to the files on the CFAST cards would be identified as a mismatch during hash code validation and hence

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any unauthorized changes would be detected.

The Examiners demonstrated the XL voting process and reviewed the system schematics and software actions. The voting process was demonstrated as follows: the terminal is opened for voting and the voter inserts a blank activation card. The voter selects the candidate choices and then selects the "Print" button. The XL prints the voter's choices on a paper vote summary record using the thermal printer. The vote summary record is then scanned and presented to the voter via the front facing voter verification window. The voter reviews and verifies the vote summary record and selects the "Cast" button. The system then saves and tabulates the votes and deposits the printed vote summary record into the collection bin without being re-scanned. During the examination of the system it was observed that the location of the print head, after the initial print, allows the vote summary record to pass to the collection bin without making contact with the print head again during the vote summary record deposit process.

The Examiners also carefully evaluated the voting process to identify any distinct cues during the printing process and observed that the printing process was audible and thus detectable. Hence, a successful attempt to activate the printer to print on the vote summary record after the voter verifies his or her selections would be heard.

The Examiners also attempted to change the tabulation of the vote by modifying the bar code on the paper vote summary record after verification by the voter but were unsuccessful. Attempts were also made to insert and tabulate modified bar codes by the system and those attempts too were unsuccessful.

3.   Documentation Review

The Examiners conducted documentation review to determine if there are acceptable security processes in place to prevent unauthorized access or tampering, and to determine if there are mechanisms in place to identify if any unauthorized or malicious acts have taken place. The system documentation cited multiple procedures in place to ensure that the security of the XL is maintained, including: warehouse security for storage/maintenance/transportation, poll worker selection, poll worker training, physical

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security of the polling place environment, physical security of the device (keys, security screws, tape, other tamper resistant/evident items), USB security, bar code security, programmatic security of the XL, as well as system auditing. The Examiner reported that the system executables and bar codes have mechanisms in place to detect unauthorized modification. Configuration of the paper vote summary record also allows the voter-verifiable text to be formatted with options to leave no blank lines between contest and selections, which prevents malicious software from leaving out a voter's selections and/or filling them in after a voter reviews their vote summary record.

B.   Examination Results and Discussion regarding Allegation #2

The Petition's allegation number two alleges that the XL violates Section 1107-A(1) of the Pennsylvania Election Code, 25 P.S. § 3031.7(1), which requires that a voting system "provides for voting in absolute secrecy and prevents any person from seeing or knowing for whom any voter, except one who has received or is receiving assistance as prescribed by law, has voted or is voting," because it stores the voter verified paper records in chronological order.

As detailed below, the Examiners evaluated these claims and determined through security analysis and evaluation, functional testing, and documentation review that the XL **does not** violate Section 1107-A(1) of the Pennsylvania Election Code because, when used in accordance with statutory and recommended procedures for maintaining proper chain of custody and canvassing votes, it provides for voting in "absolute secrecy," with exception for voters who are receiving assistance.

1.   Security Analysis and Evaluation

The security specialist reviewed the internal security, functional and architectural diagrams, software specifications, as well as the XL hardware schematic documentation. The Examiners also utilized the vulnerability assessment performed during the initial examination of the EVS 6021 voting system. The Examiners gathered information about the system security protocols and procedures in place to prevent and detect unauthorized access to the ballot bin and to maintain voter secrecy during the process of voting and after the close of polls. The Examiners then used the information gathered during this evaluation to

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identify specific test cases to be executed during the functional testing and documentation review phases.

2.   Functional Testing

The Examiners completed vote sessions and demonstrated the actions at close of polls by the poll worker. The Examiners concluded that in accordance with recommended procedures, once an election has been closed, a poll worker will not be handling the paper vote summary records which are sealed in the collection bins. The Examiners provided a recommendation suggesting that processes to randomize vote summary records should be performed at the county office in accordance with the Pennsylvania Election Code, which will be a required condition for use of this system.

3.   Documentation Review

The Examiners concluded that system documentation identifies procedures recommended by the vendor during implementation and operation to prevent violation of vote record secrecy, including: physical security to prevent and/or detect unauthorized attempts to access the paper vote summary records, assigning voters in a relatively equal distribution among multiple devices, as well as assigning multiple officials from different parties to handle vote record collection bins. In addition, vote record secrecy is maintained when statutory procedures for commingling ballots is conducted prior to canvass and storage by the county board of elections.

C.   Examination Results and Discussion regarding Allegation #8

The Petition's allegation number eight alleges that the XL violates Section 1107-A(1) of the Pennsylvania Election Code, 25 P.S. § 3031.7(1), which requires that a voting system "provides for voting in absolute secrecy and prevents any person from seeing or knowing for whom any voter, except one who has received or is receiving assistance as prescribed by law, has voted or is voting," because it requires a voter to request assistance from a poll worker during the process of "spoiling" the paper vote summary record when the voter made an error during the process of voting.

As detailed below, the Examiners evaluated these claims and determined through security analysis and evaluation, functional testing, and documentation review that the XL **does not** violate Section 1107-A(1) of the Pennsylvania Election Code because, when used in the context of proper statutory and recommended procedures for polling place setup and poll worker training, it provides for voting in "absolute secrecy," with exception for voters who are receiving assistance in the voting booth.

1.   Security Analysis and Evaluation

The security specialist reviewed the internal security, functional and architectural diagrams, software specifications, as well as the XL hardware schematic documentation. The Examiners also utilized the vulnerability assessment performed during the initial examination of the EVS 6021 voting system. The Examiners gathered information about the system security protocols and procedures in place to prevent unauthorized access to the paper vote summary records and to preclude unauthorized access to the system administration screen used during the process of assisting voters who need to spoil their ballots before they are cast. The Examiners also evaluated what, if any, malicious activity could be accomplished if an unauthorized person or persons learned the passcode used to access the system administration screen. The Examiners then used the information gathered during this evaluation to identify specific test cases to be executed during the functional testing and documentation review phases.

2.   Functional Testing

To test this Petition item, the Examiners demonstrated the process of spoiling a vote summary record and concluded that appropriate voter and poll worker training and instructions on the screen can ensure vote record secrecy. This will also be made a condition of this recertification report. The allegation about the password compromise was also reviewed and the Examiners determined that a compromise of all the characters of the supervisor password would be very difficult, and an audible chime sounds after three failed attempts to enter the password. The Examiners noted that even if the password was known to an unauthorized person, they would not be able to access any functions related to voting

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or tabulation and any actions performed by the session user are recoverable. The Examiners also noted that the position of the poll worker during the process doesn't lend itself to easily viewing the voter's choices, and also pointed out that since the voter has decided to spoil the vote summary record it is not his/her final intended vote selection.

3.   Documentation Review

The Examiners concluded that the system documentation identifies multiple procedures to protect voter privacy and prevent the compromise of the supervisor password. Please refer to Section V, Additional Conditions for Certification, for details regarding the required procedures.

V. Additional Conditions for Certification

Given the results of the reexamination that occurred in August 2019, and the findings and recommendations of the Examiners, **the Acting Secretary of the Commonwealth maintains the certification of the XL subject to the following additional conditions:**

A.   Jurisdictions selecting the XL must implement proper poll closing and vote record transportation procedures to ensure that collection bins containing paper vote summary records are sealed and transported with proper chain of custody to the county office. Poll worker training must include the details of the procedures to ensure that collection bins remain sealed until delivered to the county office. Collection bins must be opened in the presence of board of election members and must be commingled before canvass and storage, in a manner consistent with the procedure outlined for the canvassing of absentee ballots under Section 1308(e) of the Election Code, 25 P.S. § 3146.8(e).

B.   Jurisdictions implementing the XL must ensure that vote summary record instructions include specific voter and poll worker instructions added on the screen detailing spoiling procedures and cues to protect voter privacy. In addition, poll worker training must:

- Emphasize the need to obscure any view of the paper vote summary record during the process of spoiling the record;

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- Educate poll workers on the proper steps to be taken when they respond to a voter request for spoiling the vote summary record to ensure that the secrecy of the spoiled record is maintained. These steps include ensuring that the voter intends to spoil the record, has read the instructions on the screen and has been informed by the poll worker how to prevent inadvertent view of the vote summary record before the poll worker enters inside the privacy curtain;

VI.   Conclusion

As a result of the reexamination, and after consultation with the Department's staff, counsel and the Examiners, the Acting Secretary of the Commonwealth concludes that the ExpressVote XL certified as part of the EVS 6021 voting system can be safely used by voters at elections, as provided in the Pennsylvania Election Code, and meets all of the requirements set forth in the Election Code, **provided the voting system is implemented under the conditions listed in Section IV of the initial certification report released on November 30, 2018 and the conditions listed in Section V of this report**. Accordingly, the Acting Secretary maintains the certification of EVS 6021 - ExpressVote XL for use in this Commonwealth.

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Appendix A

Petition Copy

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FREE SPEECH PEOPLE.com

National Election Defense Coalition

Citizens for Better Elections

July 16, 2019

Honorable Kathy Boockvar
Acting Secretary of the Commonwealth
Pennsylvania Department of State
Bureau of Commissions, Elections and Legislation
302 North Office Building, 401 North Street
Harrisburg, PA 17120

Dear Secretary Boockvar,

Pursuant to 25 P.S. § 3031.5, on behalf of the undersigned electors of the Commonwealth of Pennsylvania, we hereby request a re-examination of the ES&S ExpressVote XL electronic voting machine. We enclose at least ten (10) certifications of duly registered electors in the Commonwealth of Pennsylvania who seek this re-examination. We have enclosed a check for $450 payable to the Treasurer of the Commonwealth of Pennsylvania.

As you know, "[t]he Secretary's duty to re-examine the machines upon proper request is mandatory." *Banfield v. Aichele*, 51 A.3d 300, 314 (Commw. Ct. Penn. 2012), *aff'd sub nom. Banfield v. Cortes*, 110 A.3d 155 (2015).

We have attached a list of deficiencies in the ExpressVote XL which require attention during re-examination. We also note that the ES&S ExpressVote HW 2.1 used as a tabulator shares many of the same deficiencies as the ExpressVote XL.

We respectfully request that the Secretary of the Commonwealth re-examine the ExpressVote XL electronic voting machine and issue a report relating to the functionality of the system. We request that this re-examination be conducted expeditiously because several counties in the Commonwealth have chosen or are considering the ExpressVote XL, and all counties must act quickly to comply with the Department of State directive to select new voter-verifiable paper record voting systems no later than December 31, 2019.

If the Secretary of the Commonwealth determines that the attached deficiencies are compelling evidence to preemptively decertify the ExpressVote XL, we would withdraw our petition for re-examination.

Respectfully submitted,

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National Election Defense Coalition

Kevin Skoglund
Chief Technologist
Citizens for Better Elections,
A member of the Protect Our Vote Philly Coalition

Petition Pages

**200 signatures by duly registered electors
in the Commonwealth of Pennsylvania**

From the counties:

**Philadelphia
Allegheny
Montgomery
Bucks
Delaware
Westmoreland
Northampton**

Attachment: ES&S ExpressVote XL Deficiencies

We seek re-examination of the ES&S ExpressVote XL voting machine on these grounds.

1. Tampering with Ballot Cards

The ExpressVote XL violates § 1107-A, 25 P.S. § 3031.7 (12), which requires that a voting system:

> "Provides acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards."

Since the Pennsylvania Certification of ES&S EVS 6.0.2.1, security researchers discovered[1] that the ExpressVote XL exposes a ballot card cast by a voter to an internal printer prior to tabulation and impoundment. The internal printer is controlled exclusively by software which has the ability to tamper with the content of the ballot card. A malfunctioning or manipulated ExpressVote XL could add, modify, or invalidate votes *after* the voter has viewed, confirmed, and cast her ballot. It could change election outcomes without detection. This is a very high impact defect which affects the integrity and auditability of the voting system.

This defect violates the principle of software independence: "A voting system is software-independent if an undetected change or error in its software cannot cause an undetectable change or error in an election outcome."[2] Software independence will be VVSG 2.0 Guideline 9.1 and is recognized as necessary for effective auditing. It is a "crucial" requirement for evidence-based elections as defined by Professors Philip Stark and David Wagner: "All three components are crucial. The risk-limiting audit relies on the integrity of the audit trail, which was created by the software-independent voting system (the voters themselves, in the case of paper ballots) and checked for integrity by

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[1] References available at:
https://freedom-to-tinker.com/2018/10/16/design-flaw-in-dominion-imagecast-evolution-voting-machine
https://freedom-to-tinker.com/2018/10/22/an-unverifiability-principle-for-voting-machines
https://securiosa.com/posts/how_the_expressvote_xl_could_alter_ballots.html
https://securiosa.com/posts/how_expressvote_barcodes_could_be_modified.html

[2] "On the Notion of Software-Independence in Voting Systems," Ronald Rivest and John Wack, *Philosophical Transactions of The Royal Society*, August 6, 2008, Page 1, *available at* https://people.csail.mit.edu/rivest/RivestWack-OnTheNotionOfSoftwareIndependenceInVotingSystems.pdf

the compliance audit."[3] Acceptable ballot security procedures to prevent tampering must include ensuring auditability and enabling evidence-based elections.

It is common sense that a voting machine should not have the ability to change votes after the voter has confirmed and cast her ballot. The same reasoning is evident and explicitly stated in § 1222, 25 P.S. § 3062 (a), "No person while handling the ballots shall have in his hand any pencil, pen, stamp or other means of marking or spoiling any ballot." Acceptable ballot security procedures to prevent tampering must include a similar restriction on any machine while handling the ballots.

2. Chronological Ballot Storage

The ExpressVote XL violates § 1107-A, 25 P.S. §.3031.7 (1), which requires that a voting system:

> "Provides for voting in absolute secrecy and prevents any person from seeing or knowing for whom any voter, except one who has received or is receiving assistance as prescribed by law, has voted or is voting."

The ExpressVote XL ballot container stores ballot cards in chronological order. It allows any poll worker or election official who knows even limited details about the sequence of voters to violate the absolute secrecy of one or more voters. A voter's ballot could be determined by referencing the order of voters in the poll book or on the poll list, by counting from the first or last ballot in the set, or by counting from another identifiable ballot, such as one with a known write-in vote. This is a significant defect. Chronologically ordered ballots fail to protect voters' right to a secret ballot and enable information harvesting, vote buying and selling, and voter coercion.

The Pennsylvania Department of State has long held the position that voting systems with chronologically ordered ballots violate absolute secrecy. Dr. Michael Shamos, statutory examiner for the Secretary of the Commonwealth from 1980 to 2010, testified to a U.S. Senate committee in 2007, "Even paper trail advocates recognize that scrolled paper trails make it easy, not just possible, to determine how every voter in a precinct voted. The first voter's ballot is first on the tape; the last voter's is last; and everyone else's is sequential order in between. A simple comparison between the paper trail and the poll list gives away everyone's vote, in violation of the Section 201 requirement of a secret ballot. Even

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[3] "Evidence-Based Elections," Philip Stark and David Wagner, *IEEE Security and Privacy*, May 8, 2012, Page 2, *available at* https://www.stat.berkeley.edu/~stark/Preprints/evidenceVote12.pdf

if only two percent of the vote is audited, it means that two percent of the voters are at risk of having their votes revealed."[4]

The "Conditions of Certification" for ES&S EVS 6.0.2.1 do not require any procedures to randomize the order of ballot cards or to otherwise protect ballot secrecy. Even if procedures had been required, the voting system cannot depend on procedures—which may not be consistently or correctly employed—to restore ballot secrecy. The voting system itself must provide it.

3. Ballot Cards Colored by Party

The ExpressVote XL violates § 1109-A, 25 P.S. § 3031.9 (e):

> "In primary elections, the Secretary of the Commonwealth shall choose a color for each party eligible to have candidates on the ballot and a separate color for independent voters. The ballot cards or paper ballots and ballot pages shall be printed on card or paper stock of the color of the party of the voter and the appropriate party affiliation or independent status shall be printed on the ballot card or at the top of the paper ballot and on the ballot pages."

The ballot cards used by the ExpressVote XL are made of solid white thermal paper. The card stock is not colored for each party. The ballot cards are blank and do not have the appropriate party affiliation or independent status printed on the ballot card.

In primary elections, the party affiliation of a voter is determined definitively when the voter checks in, signs the poll book, and is given a ballot card. Before the voter may vote, a poll worker must configure the ExpressVote XL to display the ballot style of the voter's party. If ballot cards are not on colored card stock with the party affiliation, the voter can tell the poll worker a different party affiliation, cast fraudulent votes in another party's election, and the impounded ballot card would show no evidence of the fraud. Colored card stock with the party affiliation printed also reduces the chance that a poll worker will set the wrong ballot style for a voter by accident.

It should be demonstrated that the required ballot cards are possible and that the ExpressVote XL is capable of using them.

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[4] Testimony before the U.S. Senate Committee on Rules and Administration, July 25, 2007, http://euro.ecom.cmu.edu/people/faculty/mshamos/Senate20070725.pdf

4. Serially Numbered Perforated Stubs

The ExpressVote XL violates § 1109-A, 25 P.S. § 3031.9 (f):

> "...Each ballot card shall have an attached serially numbered perforated stub, which shall be removed by an election officer before the ballot card is deposited in the district automatic tabulating equipment or in a secure ballot box. The name of the county, and a facsimile of the signature of the members of the county board shall be printed on the ballot card stub."

The ExpressVote XL violates § 1112-A, 25 P.S. § 3031.12 (b)(6), which requires a procedure for a district using paper ballots or ballot cards:

> "Following the completion of his vote, the voter shall leave the voting booth and return the ballot to the election officer by a means designed to insure its secrecy; upon removal of the stub of the ballot by the election officer, the voter shall insert the ballot into the district automatic tabulating equipment or, in the event district tabulation is not provided for by the voting system or such district tabulation equipment is inoperative for any reason, into a secure ballot box. No ballot card from which the stub has been detached shall be accepted by the election officer in charge of such equipment or ballot box, but it shall be marked "spoiled" and shall be placed in the envelope marked "Spoiled Ballots"."

In addition, § 1113-A, 25 P.S. § 3031.13 (a) requires that, after the polls have been closed, the serially numbered stubs be used as evidence of the number of ballots issued to electors so that number may be announced in the polling place and recorded.

The ballot cards used by the ExpressVote XL do not have attached serially numbered perforated stubs. The ballot cards are blank and do not have a facsimile of the signature of the members of the county board printed on the ballot card stub.

The ExpressVote XL is designed such that a voter does not handle the ballot after the completion of her vote. The voter cannot leave the voting booth with the ballot card to return it to an election officer. The election officer does not have an opportunity to remove the stub. The election officer is not able to verify that the stub has not been detached from the ballot card in order to mark it as spoiled.

Without serially numbered stubs and signatures, any person could forge ballot cards. Forged ballot cards can be submitted for tabulation secretly and independently because, unlike most district tabulating equipment, the ExpressVote XL tabulator is inside a privacy curtain, where election workers cannot observe voter activity.

Serially numbered stubs prevent "chain voting." Professor Doug Jones describes the fraud technique and the defense against it: "The organizer of the chain needs one valid ballot to begin with. He then marks this ballot and gives it to a voter willing to participate in the fraud. With each participant, the organizer instructs the participant to vote the pre-voted ballot and bring back a blank ballot from the polling place. Voters are paid for the blank ballot. The best defense against chain voting involves printing a unique serial number on a removable stub on each ballot. When ballots are issued to voters, the stub numbers should be recorded. No ballot should be accepted for deposit in the ballot box unless its stub number matches a recently issued number. Finally, to preserve the voter's right to a secret ballot, the stub should be torn from the ballot before it is inserted in the ballot box."[5]

It should be demonstrated that the required ballot cards are possible and that the ExpressVote XL is capable of using them.[6]

5.   Valid Marks on a Ballot Card

The ExpressVote XL violates § 1112-A, 25 P.S. § 3031.12 (b)(2-4), which applies to districts using paper ballots or ballot cards.

The three procedures in § 3031.12 (b)(2-4) each specify that a voter shall vote on a ballot card by "making a cross (X) or check (✓) mark or by making a punch or mark sense mark in the square opposite the name" of the candidate, the party, the write-in position, or the answer to a ballot question. The type of mark and its position relative to the name is specified six times in total.

The ExpressVote XL does not make a cross or check mark or make a punch or mark sense mark, nor does it permit a voter to do so. On an ExpressVote ballot card there is no

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[5] "On Optical Mark-Sense Scanning," Douglas W. Jones, in *Towards Trustworthy Elections*, 2010, Page 178, *available at* http://homepage.cs.uiowa.edu/~jones/voting/OpticalMarkSenseScanning.pdf

[6] Upon information and belief, the ExpressVote XL could be made to use compliant ballot cards, as ES&S apparently offered serially numbered cards in Michigan. However, the machines certified and used in Pennsylvania do not use compliant ballot cards.

square opposite the name in which to place any mark. Instead a barcode is printed near the top of the ballot card, separate and far from the name. The barcodes are not even listed in the same order as the names are listed.

The type of mark and its position relative to the name is an important requirement. A valid mark next to a corresponding name allows the voter to verify that each vote matches her intent prior to casting the ballot card, ensuring the principle of "cast as intended." A valid mark next to a corresponding name allows election officials or any person to easily observe, count, and audit the vote, without software or special equipment. The Election Code intends for the meaning of each vote to be transparent and software independent.

6.   Indicated Voting Positions on Ballot Cards

The ExpressVote XL violates § 1109-A, 25 P.S. § 3031.9 (a)(2).

> "The pages placed on the voting device shall be of sufficient number to include, following the listing of particular candidates, the names of candidates for any nonpartisan offices and any measures for which a voter may be qualified to vote on a given election day, provided further that for municipal, general or special elections, the first ballot page shall list in the order that such political parties are entitled to priority on the ballot, the names of such political parties with designating arrows so as to indicate **the voting square or position on the ballot card** where the voter may insert by one mark or punch the straight party ticket of his choice." (Emphasis added).

The ExpressVote XL violates § 1109-A, 25 P.S. § 3031.9 (d).

> "In partisan elections **the ballot cards shall include a voting square or position** whereby the voter may by one punch or mark record a straight party ticket vote for all the candidates of one party or may vote a split ticket for the candidates of his choice." (Emphasis added).

The ExpressVote XL lists political parties on the touchscreen. If a voter makes a straight party choice, the ExpressVote XL will later record the selection by printing a barcode and human-readable text on the ballot card. This process does not meet the requirements.

An electronic voting machine is required to list the political parties with arrows to indicate positions *on the ballot card*. The ExpressVote XL does not indicate voting positions on the ballot card, nor does it use any "designating arrows." In fact, there are no fixed positions on the ballot card—the location of the barcode and human-readable text will vary depending on the voter's other selections.

7. Unlawful Assistance in Voting

The ExpressVote XL would require voters to violate § 1218, 25 P.S. § 3058 (a):

> "No voter shall be permitted to receive any assistance in voting at any primary or election, unless there is recorded upon his registration card his declaration that, by reason of blindness, disability, or inability to read or write, he is unable to read the names on the ballot or on the voting machine labels, or that he has a physical disability which renders him unable to see or mark the ballot or operate the voting machine, or to enter the voting compartment or voting machine booth without assistance, the exact nature of such condition being recorded on such registration card, and unless the election officers are satisfied that he still suffers from the same condition."

The ExpressVote XL would require election officers to violate § 1111-A, 25 P.S. § 3031.11 (b):

> "At the polling place on the day of the election, each voter who desires shall be instructed, by means of appropriate diagrams and a model, in the operation of the voting device before he enters the voting booth. If any voter shall ask for further instructions concerning the manner of voting after entering the voting booth, any election officer may give him **audible instructions without entering such booth**, but no such election officer shall when giving such instructions in any manner request, suggest or seek to persuade or induce any such voter to vote any particular ticket or for any particular candidate or other person or for or against any particular question." (Emphasis added).

The ExpressVote XL would require voters and election officers to violate § 1220, 25 P.S. § 3060 (a):

"… No elector shall be allowed to occupy a voting compartment or voting machine booth already occupied by another, except when giving assistance as permitted by this act."

When any voter using the ExpressVote XL wants to spoil her ballot card or wants to handle the ballot card for physical review, they must select an option in the interface to "Quit." The ExpressVote XL displays on screen (and reads into the audio ballot) the message: "Vote Session Canceled. Your ballot was canceled with no votes cast. Ask an election official for help." The ExpressVote XL emits a chiming sound to alert a poll worker. A poll worker must enter the voting booth, touch a designated location on the screen, enter an administrator password using an on-screen keypad, and retrieve the ballot card from the windowed container where it is held.

All voters have the right to spoil their ballot card. (§ 1112-A, 25 P.S. § 3031.12 (b)(5): "Any voter who spoils his ballot may return it and secure another.") A voting system is required to allow voters to spoil their ballot card. (§ 1107-A, 25 P.S. § 3031.7 (10): "If it is of a type that uses paper ballots or ballot cards to register the vote and automatic tabulating equipment to compute such votes, the system shall provide that a voter who spoils his ballot may obtain another ballot".) The ExpressVote XL does not allow a voter to spoil her ballot card without a poll worker entering the booth in violation of the above requirements.

Voters with disabilities may wish to handle the ballot card to verify it using a magnifier or other personal assistive device. This is only possible with poll worker assistance and is only permitted if the voter has previously recorded their disability on their voter registration. Voters who have recorded a disability may "select a person" to enter the voting booth (§ 1218, 25 P.S. § 3058 (b)). This person could be a poll worker, but if another person has already been selected to assist, a poll worker entering the booth would violate the above requirements.

This deficiency has consequences for both the voter and the poll worker. § 1830, 25 P.S. § 3530 ("Unlawful assistance in voting") specifies that any voter "who, without having made the declaration under oath or affirmation required by section 1218 of this act … shall permit another to accompany him into the voting compartment or voting machine booth" or "any person who shall go into the voting compartment or voting machine booth with another while voting or be present therein while another is voting" is guilty of a misdemeanor and will be sentenced to pay a fine, imprisonment, or both.

8.   Poll Workers in the Booth and Ballot Secrecy

The ExpressVote XL violates § 1107-A, 25 P.S. § 3031.7 (1), which requires that a voting system:

> "Provides for voting in absolute secrecy and prevents any person from seeing or knowing for whom any voter, except one who has received or is receiving assistance as prescribed by law, has voted or is voting."

The ExpressVote XL violates the Help America Vote Act of 2002 (HAVA), § 301(a)(1)(A)(ii), which requires that a voting system shall:

> "provide the voter with the opportunity (in a private and independent manner) to change the ballot or correct any error before the ballot is cast and counted (including the opportunity to correct the error through the issuance of a replacement ballot if the voter was otherwise unable to change the ballot or correct any error)"

The previously described procedure for spoiling a ballot card on the ExpressVote XL allows the poll worker, upon entering the voting booth, to view the selections on the ballot card through the windowed container and while handling the ballot card. The poll worker will look directly at the ballot card while extracting it from the container. The poll worker can see and know for whom the voter has voted or is voting. The ExpressVote XL does not allow any voter to privately and independently correct an error through the issuance of a replacement ballot.

It is also noteworthy that this procedure reveals an administrator password to the voter. The poll worker enters the password in front of the voter using an on-screen keypad and each character is displayed in the input field as it is typed. During public demonstrations of the ExpressVote XL, several members of the public reported easily observing the administrator password used.

9.   Accessibility

The ExpressVote XL violates § 1107-A, 25 P.S. § 3031.7(5), which requires that a voting system:

> "Permits **each** voter to vote for any person and any office for whom and for which he is lawfully entitled to vote, whether or not the name of such

person appears upon the ballot as a candidate for nomination or
election." (Emphasis added).

The ExpressVote XL violates § 1107-A, 25 P.S. § 3031.7(3), which requires that a voting
system:

> "Permits **each** voter...to vote a straight political party ticket...by one mark
> or act, to vote for all the candidates of one political party for every office to
> be voted for, and every such mark or act shall be equivalent to and shall be
> counted as a vote for every candidate of the political party so marked
> including its candidates for presidential electors, except with respect to
> those offices as to which the voter has registered a vote for individual
> candidates of the same or another political party or political body; in which
> case the automatic tabulating equipment shall credit the vote for that office
> only for the candidate individually so selected, notwithstanding the fact that
> the voter may not have individually voted for the full number of candidates
> for that office for which he was entitled to vote." (Emphasis added).

The ExpressVote XL violates the Help America Vote Act of 2002 (HAVA), § 301(a),
which requires that a voting system shall:

> 1.A.i: "permit the voter to verify (in a private and independent manner) the
> votes selected by the voter on the ballot before the ballot is cast and
> counted."

> 1.A.ii: "provide the voter with the opportunity (in a private and independent
> manner) to change the ballot or correct any error before the ballot is cast
> and counted (including the opportunity to correct the error through the
> issuance of a replacement ballot if the voter was otherwise unable to change
> the ballot or correct any error)."

> 3.A: "be accessible for individuals with disabilities, including nonvisual
> accessibility for the blind and visually impaired, in a manner that provides
> the same opportunity for access and participation (including privacy and
> independence) as for other voters."

To the extent that any HAVA Section 261 funds are involved, use of the ExpressVote XL
also violates HAVA § 261 (b):

> An eligible State and eligible unit of local government shall use the payment received under this part for— (1) making polling places . . . accessible to individuals with disabilities, including the blind and visually impaired, in a manner that provides the same opportunity for access and participation (including privacy and independence) as for other voters.

The Pennsylvania Certification of ES&S EVS 6.0.2.1 included an accessibility testing report on pages 68-94. The ExpressVote XL was harshly reviewed by the accessibility test group.

"Every participant had at least one problem, despite relatively high election knowledge and digital experience, suggesting that the issue would be more severe for voters without these personal resources to help them understand what is happening." (Page 70)

"None of the participants could verify the ballot in the glass cage:
  • Blind voters had no access to the ballot to use personal technology
  • Low vision voters could not position the ballot so they could read the small text
  • Other voters had problems reading the ballot because of glare and because the sides of the ballot were obscured by the cage.
  • Although it is possible to have the ballot ejected to handle it while verifying, the procedure is unclear and it requires voters to tell the system they want to "Quit" and call a poll worker." (Page 74)

Participants in the accessibility study found the ExpressVote XL made it difficult to cast write-in votes. For a vote for a write-in candidate to count, spelling must be perfect and "[a]ll of the participants knew that a misspelled write-in would not be counted, but could not figure out how to review what was typed." (Pages 70-71, 86-87). Furthermore, the ExpressVote XL did not allow participants to review any write-in votes through the audio ballot because the text of the write-in is not encoded in the barcodes printed on the ballot card. (Pages 73, 75, 88).

Voters relying on the audio ballot had significant issues with voting a "straight-party" ticket. If a voter selects a single candidate outside the straight-party ticket, the ExpressVote XL deselects all other candidates, without informing the audio-guided voter. The accessibility testing report describes this problem as "not only a failure to vote independently, but identifying and solving the problem requires revealing their votes to a poll worker or assistant." (Pages 68-69). The audio ballot also "does not announce the party of each candidate. This made it impossible to

complete tasks based on party, including confirming straight party selections." (Pages 83, 86).

The Pennsylvania Department of State's accessibility testing report makes it clear that the ExpressVote XL is not accessible for individuals with disabilities "in a manner that provides the same opportunity for access and participation (including privacy and independence) as for other voters." Most importantly for these voters, it does not "permit the voter to verify (in a private and independent manner) the votes selected by the voter on the ballot before the ballot is cast and counted."

10. The *Stein* Settlement

The ExpressVote XL violates the settlement in *Stein v. Cortes*:[7]

> "2. The Secretary will only certify new voting systems for use in
> Pennsylvania if they meet these criteria:
> > a. The ballot on which each vote is recorded is paper;
> > b. They produce a voter-verifiable record of each vote; and
> > c. They are capable of supporting a robust pre-certification auditing
> >   process.
>
> 3. The Secretary will continue to direct each county in Pennsylvania to
> implement these voting systems by the 2020 primaries, so that every
> Pennsylvania voter in 2020 uses a voter-verifiable paper ballot."

The ExpressVote XL does not provide the voter a paper ballot, as that term is defined by 25 P.S. § 3031.1. Instead, it provides a "ballot card." A paper ballot is a piece of paper with the options pre-printed, whereas a ballot card only prints a voter's selection on blank piece of paper. *See id.* (defining paper ballot as "a printed paper ballot which conforms in layout and format to the voting device in use" and ballot card as "a card which is compatible with automatic tabulating equipment and on which votes may be registered").

Because the ExpressVote XL does not provide a paper ballot, Pennsylvania voters in counties using the ExpressVote XL will not receive a voter-verifiable paper ballot in 2020, in contravention of the *Stein* settlement's requirement that the Secretary "direct each county in Pennsylvania to implement these voting systems by the 2020 primaries, so that every Pennsylvania voter in 2020 uses a voter-verifiable paper ballot."

---

[7] *Stein v. Cortes*, No. 16-cv-06287, ECF No. 108 (E.D. Pa. Nov. 28, 2018), *available at* http://bit.ly/SteinSettlement.

Exhibit C

EMERY CELLI BRINCKERHOFF & ABADY LLP

RICHARD D. EMERY
ANDREW G. CELLI, JR.
MATTHEW D. BRINCKERHOFF
JONATHAN S. ABADY
EARL S. WARD
ILANN M. MAAZEL
HAL R. LIEBERMAN
DANIEL J. KORNSTEIN
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CHARLES J. OGLETREE, JR.
EMERITUS

DIANE L. HOUK
JESSICA CLARKE

ALISON FRICK
DAVID LEBOWITZ
DOUGLAS E. LIEB
ALANNA KAUFMAN
EMMA L. FREEMAN
DAVID BERMAN
ASHOK CHANDRAN

July 29, 2019

Sent via FedEx and Email

Kathleen M. Kotula
Timothy E. Gates
Department of State
Office of Chief Counsel
306 North Office Building
401 North Street
Harrisburg, PA 17120-0500
tgates@pa.gov

> *Re: Stein v. Cortes,* No. 16-CV-6287
> Notice of Non-Compliance with Settlement Agreement

Dear Ms. Kotula and Mr. Gates:

We represent Plaintiffs in this case. Pursuant to Section 5, Paragraphs 13-14 of the Settlement Agreement (Ex. A), we write to alert you that Defendants' certification of the ES&S ExpressVote XL ("ExpressVote") system violates the terms of the Settlement Agreement and must be rescinded.

Under the Settlement Agreement, "[t]he Secretary will only certify new voting systems for use in Pennsylvania if they meet these criteria:"

      a.   The ballot on which each vote is recorded is paper;
      b.   They produce a voter-verifiable record of each vote; and
      c.   They are capable of supporting a robust pre-certification auditing process.

See Ex. A ¶ 2. The Express Vote, however, does not produce a "voter-verifiable record of each vote."
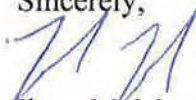
EMERY CELLI BRINCKERHOFF & ABADY LLP
Page 2

According to the ES&S summary of the machine (Ex. B) and Dr. Halderman, the ExpressVote prints a summary card of the voter's selection, which "includes text and an optical scan barcode." The voter can verify the text. The voter cannot verify the barcode. But the *barcode*, not the text, is counted as the voter's vote.

Under the Settlement Agreement, voters must be able to verify their own vote. But there is no way for a voter to know whether the text and the barcode reflect the same vote. It is perfectly possible for a malfunctioning, hacked, or compromised machine to print one thing in the text, another thing in the barcode. To avoid these sorts of problems, the Settlement Agreement requires that voters be able verify, with their own eyes, what their vote is, before it is counted. The ExpressVote does not allow voters to do that.

We look forward to hearing from you soon and hope you will agree to rescind your office's certification of these machines. Absent agreement, we intend to seek relief from the Court.

Sincerely,

Ilann M. Maazel
Alison Frick
Doug Lieb

Enclosures:
    Ex. A: Settlement Agreement
    Ex. B: ES&S Summary

c. Sue Ann Unger
Sr. Deputy Attorney General
PA Office of Attorney General
1600 Arch Street, Suite 300, Phila., PA 19103
sunger@attorneygeneral.gov

Exhibit D

COMMONWEALTH OF PENNSYLVANIA
GOVERNOR'S OFFICE OF GENERAL COUNSEL

September 12, 2019

VIA OVERNIGHT DELIVERY AND EMAIL

Ilann M. Maazel
Alison Frick
Douglas E. Lieb
Emery Celli Brinckerhoff & Abady
600 Fifth Avenue, 10th Floor
New York, New York 10020

   Re: *Stein v. Cortes*, No. 16-CV-6287 (E.D. Pa.)

Dear Messrs. Maazel and Lieb and Ms. Frick:

   This letter will serve as a response to your letter dated July 29, 2019, wherein you allege that my client is in violation of the parties' settlement agreement in this matter. In particular, you allege that the ES&S ExpressVote XL ("XL") "does not produce a 'voter-verifiable record of each vote.'" We disagree. The XL device prints a paper vote summary record with the voter's selections recorded in both a barcode and as human-readable text. After printing, the XL allows the voter to view, verify, and, if necessary, spoil his or her paper record if it does not accurately reflect his or her choices. In addition, the paper record is capable of supporting a robust pre-certification audit process. Therefore, the XL device fully complies with the three requirements in the settlement agreement.

   Moreover, as you know, the XL was recently reexamined, and based on the reexamination, most of which focused on security testing, the Acting Secretary determined that the XL can safely be used by voters and should maintain its certification for use in the Commonwealth.

   Apart from the single concern raised in your letter of July 29, 2019, you also voiced concerns during our phone conversation on August 26, 2019, related to Paragraph 4b of the settlement agreement. Specifically, you questioned why Dr. Halderman was not notified of the reexamination of the XL device, and why he had not yet received video recordings of the Hart and Clear Ballot examinations. While these concerns were not raised in your letter, my client wishes to respond to them in the interests of cooperation and transparency.

Emery Celli Brinckerhoff & Abady
September 12, 2019
Page 2 of 3

As you know, the parties' settlement agreement merely provides that "the Secretary shall ensure that the Plaintiffs are made aware of all . . . **Commonwealth on-site certification testing** for Voting Systems." As I explained to you on the call, the XL reexamination was conducted at SLI's offices in Denver, **not on-site** here in Harrisburg. This was done because the reexamination dealt mostly with security testing, and all security testing of all current voting systems has been performed off-site in the examiner's test lab. As to the Hart examination, the Acting Secretary fulfilled her obligation to your client by notifying Dr. Halderman via email of the Hart on-site examination that took place on January 22-29 of this year (which he attended). The same notice was provided for the Clear Ballot on-site examination which was conducted before the settlement agreement became effective. Nevertheless, in the interest of transparency, and specifically reserving all rights in the settlement agreement, my client has agreed to make available to Dr. Halderman the video recording of the public portions of the Hart examination. With respect to Clear Ballot, the video relates to a version of the system that was withdrawn from state certification. The certified version was examined off-site in early 2019. However, because the withdrawn version closely mirrors the version currently certified for use, the Department is working with Clear Ballot to make the video of the public portions of the previous examination available.

Finally, during our aforementioned phone conversation, you inquired as to how many counties were moving from DREs to new non-DRE systems. And in an email dated September 10, 2019, you asked for a "summary concerning progress PA counties have made to go paperless (i.e., how many switched from DRE to optiscan, from DRE to BMDs, how many today are optiscan, etc.) have made to go paperless (i.e., how many switched from DRE to optiscan, from DRE to BMDs, how many today are optiscan, etc.)." My client informs me that, as recently as the 2018 general election, fifty counties were solely DRE-based, and another four used a mix of DRE and optical scan systems. To date, 49 counties—73 percent—have taken official action to transition to new voting systems with a voter-verifiable record of each vote. Although the numbers are subject to change, it's the Department's understanding 37 counties will implement their new systems as primarily hand-marked paper ballots, ten as BMDs, and two will let voters choose between hand-marked and BMDs at the polling place. Impressively, 46 of those 49 counties are implementing their new systems for this November's municipal election. There are an additional six counties that are still using older models of paper ballot systems, so factoring in those, by the November 2019 election, at least 52 of the 67 counties will be using voting systems with voter-verifiable paper records. I trust these numbers put in perspective the enormity of the challenge my clients faced and are in the process of overcoming.

Please let me know when you'd like to schedule the follow-up call you suggested during our previous conversation. Senior Deputy Attorney General Unger is unavailable due to travel

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PA pennsylvania

Emery Celli Brinckerhoff & Abady
September 12, 2019
Page 3 of 3

until September 23, 2019.

Sincerely,

Timothy E. Gates
Chief Counsel

cc: Sue Ann Unger, Senior Deputy Attorney General

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PA pennsylvania

Exhibit E

EMERY CELLI BRINCKERHOFF & ABADY LLP

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EARL S. WARD
ILANN M. MAAZEL
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DIANE L. HOUK

ALISON FRICK
DAVID LEBOWITZ
DOUGLAS E. LIEB
ALANNA KAUFMAN
EMMA L. FREEMAN
DAVID BERMAN
ASHOK CHANDRAN

October 1, 2019

Via Overnight Mail and Email

Timothy E. Gates
Department of State
Office of Chief Counsel
306 North Office Building
401 North Street
Harrisburg, PA 17120-0500
tgates@pa.gov

> *Re: Stein v. Cortes,* No. 16-CV-6287
> Second Notice of Non-Compliance with Settlement Agreement

Dear Mr. Gates:

Pursuant to Section 5, Paragraphs 13-14 of the Settlement Agreement, we write again to alert you that Defendants' certification of the ES&S ExpressVote XL ("ExpressVote") system violates the terms of the Settlement Agreement and must be rescinded.

First, as previously noted, under the Settlement Agreement, "[t]he Secretary will only certify new voting systems for use in Pennsylvania if . . . [t]hey produce a *voter-verifiable* record of each vote." Notwithstanding your September 12 letter, the ExpressVote system does not produce a "voter-verifiable record of each vote." The ExpressVote prints a summary card of the voter's selection, which includes text and an optical scan barcode. The voter can verify the text, but not the barcode. But the ExpressVote counts the *barcode*, not the text, as the voter's vote. Voters must be able to verify their own votes with their own eyes. That is the entire point of voter-verifiability. No voter can understand what a barcode means. No voter can know if the barcode accurately reflects his or her vote. Unless that fundamental problem is corrected, the ExpressVote may not, consistent with the Settlement Agreement, be used in the Commonwealth.

EMERY CELLI BRINCKERHOFF & ABADY LLP
Page 2

Second, the Settlement Agreement requires "paper ballots" for each voter. The summary card is not a paper ballot, in its presentation or in its method of production. It is also extremely difficult for any voter to read and understand this summary card before choosing to "cast."

Third, the ExpressVote requires voters to insert their summary card into a machine that registers their selections, scans and prints, and is able to print onto the summary card after the voter chooses to "cast." This allows the machine (whether through malfunction or hacking) to print a false vote onto the summary card *after* the voter attempted to verify their vote. This flaw prevents the ExpressVote from "supporting a robust pre-certification auditing process," as required under the Settlement Agreement. An audit is only as good as the paper being audited. Without confidence that the summary card is accurate, we cannot have confidence in the audit of votes using the ExpressVote.

Finally, we are concerned about the lack of transparency of the ExpressVote recertification. Even if, as set forth in your letter, the reexamination "mostly" concerned security, the letter and spirit of the Settlement Agreement require Dr. Halderman to able to "attend" these examinations, certainly as to non-security testing if not all the testing.[1]

So many systems comply with the Settlement Agreement, including the cheapest and best system: paper with OptiScan machines. But this ExpressVote is not one of them.

Plaintiffs, including Pennsylvania citizens, worked very hard to achieve this Settlement Agreement. They are entitled to full compliance. Unless the ExpressVote certification is promptly rescinded, we will seek court relief.

Sincerely,

/s

Ilann M. Maazel
Alison Frick
Doug Lieb

c. Sue Ann Unger, Esq.

---

[1] Thank you for agreeing to make the Hart and Clear Ballot videos available to Dr. Halderman. We hope this can be achieved in an expeditious manner. Thank you also for your update concerning overall efforts to comply with the Settlement Agreement.

Exhibit F

COMMONWEALTH OF PENNSYLVANIA
GOVERNOR'S OFFICE OF GENERAL COUNSEL

October 30, 2019

VIA OVERNIGHT DELIVERY AND EMAIL

Ilann M. Maazel
Alison Frick
Douglas E. Lieb
Emery Celli Brinckerhoff & Abady
600 Fifth Avenue, 10th Floor
New York, New York 10020

      Re: *Stein v. Cortes*, No. 16-CV-6287 (E.D. Pa.)

Dear Messrs. Maazel and Lieb and Ms. Frick:

      This letter will serve as a response to your letter dated October 1, 2019, wherein you allege, for a second time, that my client is in violation of the parties' Settlement Agreement ("Agreement") in this matter. In particular, you again allege that the ES&S ExpressVote XL ("XL") "does not produce a 'voter-verifiable record of each vote.'" We continue to disagree. In addition, you now allege that the summary card is not a paper ballot as required by the Agreement.

      First, the XL device prints a paper vote summary record with the voter's selections recorded in both a barcode and as human-readable text. This vote summary record satisfies Section 2, Paragraph 2(a) of the Agreement as voter selections are clearly recorded on paper. Second, after each vote is recorded on paper, the XL allows the voter to view, verify, and, if necessary, spoil his or her paper record if it does not accurately reflect his or her choices. This process satisfies Section 2, Paragraph 2(b) of the Agreement as each vote cast is verifiable by the voter. Third, the paper record is capable of supporting a robust pre-certification audit process thereby satisfying Section 2, Paragraph 2(c) of the Agreement. As a result, the XL device fully complies with Section 2 of the Agreement.

      In an effort to address your allegation that the XL is capable of "print[ing] a false vote onto the summary card *after* the voter attempted to verify their vote," let me suggest that you read Page 7 of the Report Concerning the Reexamination Results of Election Systems and

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Ilann Maazel
October 30, 2019
Page 2

Software ExpressVote XL that was issued by the Acting Secretary on September 3, 2019.[1] As you will note in the report, it was demonstrated by the examiner that the XL voting process after the voter inserts a blank activation card is as follows: the voter selects the candidate choices and then selects the "Print" button. The XL prints the voter's choices on a paper vote summary record using the thermal printer. The vote summary record is then scanned and presented to the voter via the front facing voter verification window. The voter is then able to review and verify the vote summary record prior to selecting the "Cast" button. Importantly and contrary to your allegation, it was observed by the examiner that the location of the print head, after the initial print, scan and verification, "allows the vote summary record to pass to the collection bin **without making contact** with the print head again during the vote summary record deposit process."

In my previous letter I addressed your question of why Dr. Halderman was not notified of the reexamination of the XL. Since you raise the concern again, I will reiterate my previous response. The parties' settlement agreement merely provides that "the Secretary shall ensure that the Plaintiffs are made aware of all . . . **Commonwealth on-site certification testing** for Voting Systems." As I explained to you on the call, the XL reexamination was conducted at SLI's offices in Denver, **not on-site** here in Harrisburg. This was done because the reexamination dealt mostly with security testing, and all security testing of all current voting systems has been performed off-site in the examiner's test lab. I will add that the off-site reexamination was conducted on an already certified voting system as the XL was certified by the Secretary on November 12, 2019, prior to the effective date of the Settlement Agreement.

Please let me know when you'd like to schedule the follow-up call to discuss.

Sincerely,

Timothy E. Gates
Chief Counsel

cc: Sue Ann Unger, Senior Deputy Attorney General

---

[1]

https://www.dos.pa.gov/VotingElections/Documents/Voting%20Systems/ESS%20EVS%206021/Reexamination%20Results%20(ExpressVote%20XL)%2009-03-2019.pdf

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Exhibit G

COUNTY OF NORTHAMPTON

BECKY BARTLETT
DEPUTY DIRECTOR OF ADMINISTRATION

OFFICE OF THE COUNTY EXECUTIVE
NORTHAMPTON COUNTY GOVERNMENT CENTER
669 WASHINGTON STREET
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Phone: 610-829-6250
Fax: 610-559-3722
Email: bartlett@northamptoncounty.org

November 6, 2019

FOR IMMEDIATE RELEASE

> **Contact: Becky Bartlett**
> **610-829-6250**
> bbartlett@northamptoncounty.org

The following is a statement from Amy Hess, the Acting Registrar for the Election's Office of Northampton County.

Voters in Northampton County reported irregularities while voting on the ES&S ExpressVote XL machines during the election held on November 5, 2019. Multiple employees from the Elections Office and ES&S worked throughout the day to address reported issues.

During the initial reading of the results, it became apparent that there was a problem with the tabulation in some of the precincts. After receiving information from Northampton County, the Pennsylvania Department of State instructed the County to use the paper ballots, not the machine count, to tabulate results. ES&S has assured the County and the Pennsylvania Department of State that it is assessing and diagnosing what caused the issues with the machines.

While it is unfortunate that Northampton County experienced these problems during the November 5th election, we anticipate being able to complete the count using the machine generated paper ballots and we are grateful to the Department of State for requiring all Pennsylvania voting machines to produce a paper trail.

The paper ballots are being counted and election results will be released to the public when they are available.

This is the first election the County has used the ES&S ExpressVote XL voting machines which were purchased in March 2019.

<div align="center">###</div>

Exhibit H

THE MORNING CALL

NOTE TO READERS ON DELIVERY OF TODAY'S NEWSPAPER ✖

Arts and crafts chain A.C. Moore to close all of its stores, including 2 in the...

Police seek woman charged in fatal drug overdose of husband found with bags ...
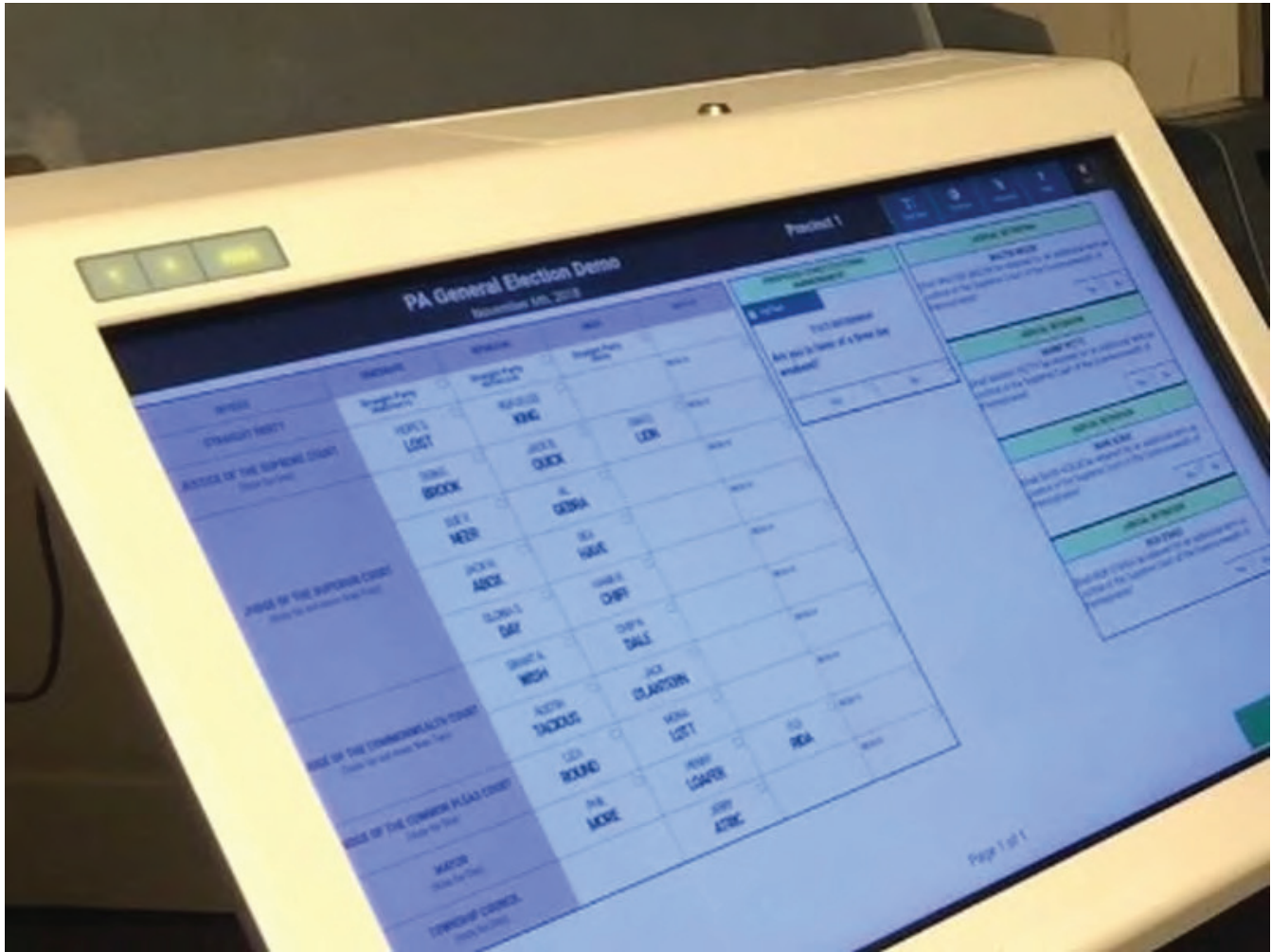
Note to readers on delivery of Tuesday's newspaper

⟩

Northampton County to rescan ballots after GOP chair calls for recount: 'We have a hanging chad moment'

By EMILY OPILO and TOM SHORTELL
THE MORNING CALL | NOV 06, 2019

🐦 f ↪

The ExpressVote XL voting machine. In March 2019, Northampton County's election commission voted 3-2 to use the machines in future elections. (Tom Shortell / Morning Call file photo)

Northampton County officials are rescanning ballots cast countywide after questionable results were reported by newly implemented voting machines Tuesday, prompting the head of the county Republican party to demand a recount.

Calling the situation "unfortunate," Northampton County officials issued a statement shortly before midnight acknowledging a problem with counting votes in some county precincts. Voters reported irregularities throughout the day while voting on the machines, and state officials were contacted, the county officials said.

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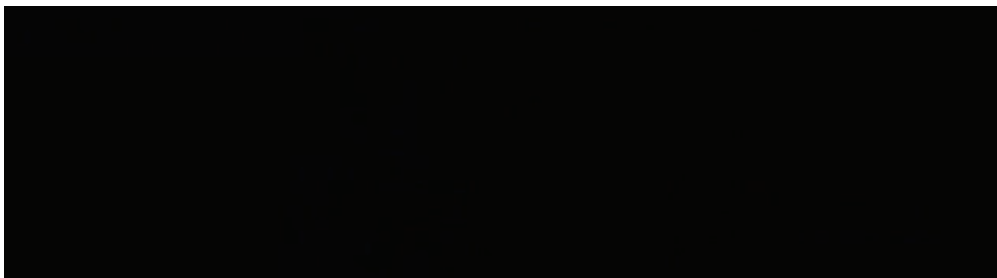
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The state instructed the county to use paper ballots, not the machine counts, to tabulate its votes.

"ES&S has assured the county and the Pennsylvania Department of State that it is assessing and diagnosing what caused the issues with the machines," the news release stated.

Red flags with the results were apparent as even the earliest returns rolled in. Democrat Abe Kassis initially had zero recorded votes with multiple precincts reporting.

[More News] Police seek woman charged in fatal drug overdose of husband found with bags of frozen vegetables on his head »

Lee Snover, head of the Northampton County Republican Party, quickly called for a recount of the paper ballots in at least the judicial contest, saying "I need to win this race."

"We have a hanging chad moment here in Northampton County," she said, referring to voting machine issues that caused the infamous recount of contested ballots in Florida during the 2000 presidential election.

With 105 of 155 precincts reporting, Democratic candidate Abe Kassis had received just 164 votes. Democrat John Morganelli had 28,582 and Republican Victor Scomillio had 17,185.

Snover said she was unsure how quickly a recount could take place since the paper ballots were in voting machines spread across the county.

[More News] Note to readers on delivery of Tuesday's newspaper »

New voting machines were used for the first time in Northampton County and Lehigh County this cycle as well as across much of the state in response to attempted election interference during the 2016 presidential race. The new machines are required to produce a voter-verifiable paper trail.

County Executive Lamont McClure said he believed the issues with the machines were limited to the judicial race, but poll workers across Northampton County flagged questionable results in at least six other municipal races.

Kassis said there was an issue with the way the votes have been counted by the new machines.

"I understand that the county is looking into it and attempting to remedy the situation, so I will wait to see what further develops," Kassis said around 9 p.m.

[More News] PA lawmaker: Ban hand-held cellphone use while driving. Neighboring states already do »

Morganelli, who opted not to run for reelection as district attorney in favor of a bid for judge, said the fact that the initial results showed no votes for Kassis suggested a "systematic breakdown" across the county. The results for himself and Scomillio seemed to be where he would expect them to be, Morganelli said at about 9 p.m.

"In elections, you want confidence that the results are correct," he said.

Riley Yates ✔
@riley_yates

Before I left, I noticed a prop check displayed prominently on the wall of the office. It was for $341,969.77 to the county from the Pennsylvania Department of State. The memo line: for the "New voting system." twitter.com/riley_yates/st…

> **Riley Yates** ✔ @riley_yates
> #lvelections I just got kicked out of the elections office by a deputy sheriff. Not a great look for the county's transparency.

♡ 4   10:32 PM - Nov 5, 2019   ⓘ

👤 See Riley Yates's other Tweets   ›

McClure said he believed that the outcomes in most countywide races were accurate with results falling in line with historical outcomes. When pressed about the Northampton County judge race, McClure said he believes that issues were tied to just a single candidate – Kassis.

The office of Voter Registration is working with ES&S, the company that sold the county the new voting machines, to determine why there was a severe undercounting of Kassis' votes.

[More News] Northampton County election won't be challenged, GOP says. Here's why »

"As I look at the results, most of them appear consistent with what you might expect in these races at this juncture," he said.

> **Tom Shortell, Road Warrior** ✓
> @TShortell
>
> "We have a hanging chad moment here in Northampton County," says Lee Snover. She is demanding a count of the paper ballots in the disputed county judge race.
>
> ♡ 7   10:35 PM - Nov 5, 2019   ⓘ
>
> See Tom Shortell, Road Warrior's other Tweets ›

McClure acknowledged there were reports of problems in voting precincts across the county and blamed the problems on a few bad machines. The county must do better next year when the hotly contested presidential election drives enormous turnout to the polls, he said.

"I think we had some growing pains. There were some units that did not live up to our expectations," he said.

Poll workers reporting results to The Morning Call have also raised concerns about results in Bushkill, Upper Mount Bethel, Hanover and Williams townships, the race for Bangor school board and one precinct in Easton.

[More News] Fed up with noise citations, Maingate owner says he's closing nightclub »

A Morning Call reporter was forced to leave the Northampton County elections office by a deputy sheriff around 10:30 p.m.

Snover said the results for some candidates were so skewed that she had serious doubts about all the numbers coming out of Northampton County. Snover said she was reaching out to her solicitor, seeking advice on how the party should proceed.

"I'm shaking here. I have no idea if these numbers are right," she said.

Matt Munsey, chairman of the Northampton County Democrats, said it appeared from the unofficial results that there were some issues with not only Kassis' tally but also at least one race in Wilson. Munsey stopped short of calling for a recount, saying he needed more information about what went wrong with the voting system.

Munsey said he was hopeful that the issue could be fixed Tuesday night.

Just before 10 p.m., Munsey said he was in the Northampton County Courthouse with a line of poll workers wrapped around the rotunda. He said the new process would take a little patience.

John Simpson, a judge of elections for Lower Nazareth 2, said he was sure the results printed off the machines in his precinct were incorrect because they recorded zero votes for Kassis. Simpson said he personally cast at least one vote. There didn't appear to be issues with any other races, he said.

"One flaw on a new machine being used for the first time? All right. I feel bad, but I could see where that can happen," Simpson said, adding that he was glad he wasn't running for election this cycle.

"I don't think it will happen in any future races," Simpson said. "This one is going to make them look so much closer."

Issues with the new machines are not limited to Northampton County. State election officials said several precincts in York County experienced problems related to ballots printed on the wrong paper size, which caused problems feeding the scanner. Those ballots were to be counted by hand, and new ballots were printed once the problem was identified.

York County's board of commissioners issued a news release Tuesday evening apologizing to voters for issues at the county's polling sites, saying officials misjudged the time it would take to scan two ballot sheets per person. County election officials are working to address the issue before a January special election, they said.

Despite those hurdles, state officials described no widespread issues as 45 counties across Pennsylvania deployed new voting machines.

Pennsylvania mandated the new machines in response to attempted interference in the 2016 presidential race by Russian hackers. Pennsylvania was one of nearly two dozen states targeted.

Morning Call reporters Nicole Radzievich, Riley Yates and Laura Olson contributed to this report.

Emily Opilo

Emily Opilo is an investigative reporter for The Morning Call, and previously covered Allentown City Hall for six years. A native of central Pennsylvania, she previously wrote about politics for the York Daily Record and Harrisburg schools for The Patriot-News. She holds a master's from Syracuse University and a bachelor's from American University.

Tom Shortell

Tom Shortell covers transportation and county government in the Lehigh Valley for The Morning Call. He's previously covered the Slate Belt, Northampton County Court, Jersey City, NJ and the Jersey Shore. A graduate of St. Bonaventure University, Shortell will gladly pay you Tuesday for a hamburger today.

Taboola Feed

Ex-Parkland student found guilty of four killings in Florida, faces death penalty

Ex-Parkland High School student says it was self-defense that led him to kill his ex-girlfriend, parents and boyfriend in brutal Florida homicides.

The Morning Call

Models don eye-popping looks in tape-only swimsuit show

NY Daily News

VIDEO: Aftermath of 7th Street arrest of retail theft suspect

Neighbors gather to watch the aftermath of the forceful arrest of a man suspected of retail theft who punched two Allentown police officers on 7th Street.

The Morning Call

8 rushed to hospital in crash after Upper Macungie Township man loses consciousness behind the wheel, police say

An Upper Macungie Township man careened through a red light and smashed into two vehicles on Hamilton Boulevard at Breinigsville Road.

The Morning Call
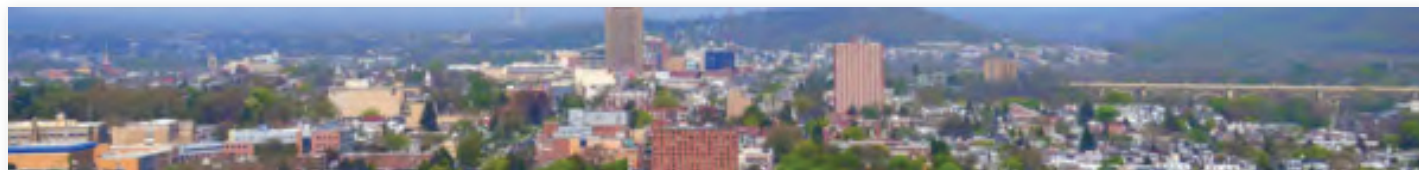
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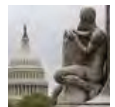
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Exhibit I

Cybersecurity

Expensive, Glitchy Voting Machines Expose 2020 Hacking Risks

Paper ballots may be safer and cheaper, but local officials swoon at digital equipment.

By Kartikay Mehrotra and Margaret Newkirk
November 8, 2019, 3:30 PM EST

A man casts his ballot at polling station in New Jersey in 2016. *Photographer: Eduardo Munoz Alvarez/AFP via Getty Images*

The first sign something was wrong with Northampton County, Pennsylvania's state-of-the-art voting system came on Election Day when a voter called the local Democratic Party chairman to say a touchscreen in her precinct was acting "finicky." As she scrolled down the ballot, the tick-marks next to candidates she'd selected kept disappearing.

Her experience Nov. 5 was no isolated glitch. Over the course of the day, the new election machinery, bought over the objections of cybersecurity experts, continued to malfunction. Built by Election Systems & Software, the ExpressVote XL was designed to marry touchscreen technology with a paper-trail for post-election audits. Instead, it created such chaos that poll

workers had to crack open the machines, remove the ballot records and use scanners summoned from across state lines to conduct a recount that lasted until 5 a.m.
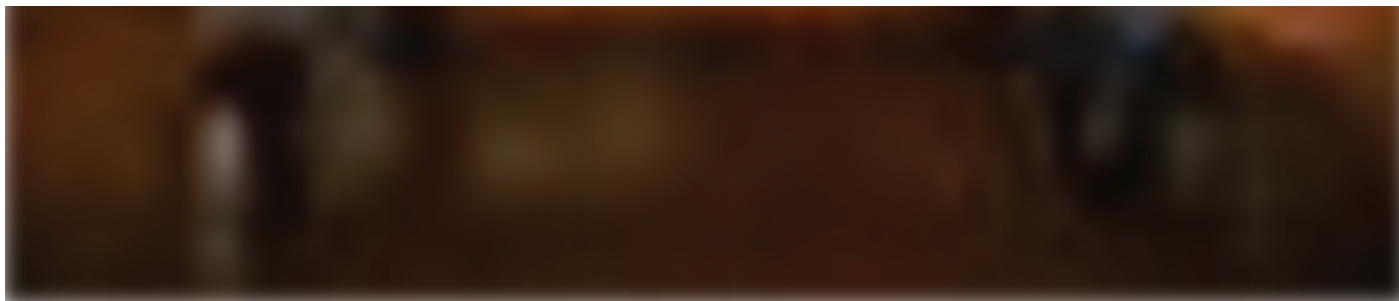
The ExpressVote XL voting machine during a demonstration at the Reading Terminal Market in Philadelphia on June 13, 2019. *Photographer: Matt Rourke/AP Photo*

In one case, it turned out a candidate that the XL showed getting just 15 votes had won by about 1,000. Neither Northampton nor ES&S know what went wrong.

Digital voting machines were promoted in the wake of a similarly chaotic scene 19 years ago: the infamous punch-card ballots and hanging chads of south Florida that tossed the presidential contest between George W. Bush and Al Gore into uncertainty.

But now, the machinery that was supposed to be the solution has spawned a whole new controversy, this time with national security at stake—the prospect of foreign states disrupting American elections.

Security experts say the cheapest, and to their minds, most reliable and hack-proof method to cast votes also happens to be the lowest tech: paper ballots marked by hand and fed through scanners (no chads) to tally the results. They have called for replacing computerized equipment —particularly paperless older models—with the decidedly Luddite alternative.

The devices have "raised far more security questions than paper ballots because you have a potentially hackable computer standing between the voter and the record," said J. Alex Halderman, a computer science professor at the University of Michigan, adding that without sufficient research, these new machines could be "a waste of money."

Election Insecurities
Mixing in paper ballots could halve the cost of an election while bolstering security

Source: University of Pittsburgh Institute for Cyber Law, Policy and Security & Citizens for Better Elections
Note: Estimates are based on recent expenditures in counties across Pennsylvania.

The switch to paper can't come soon enough, they fear, as election officials prepare for the first presidential election since Russia meddled in the 2016 race, hacking Democratic Party emails

and targeting election systems in all 50 states, according to federal authorities. While there didn't appear to be any votes changed or election machines manipulated in that race, there's little doubt that U.S. adversaries will try again. "Russia, China, Iran and other foreign malicious actors all will seek to interfere in the voting process or influence voter perceptions," national security leaders including Attorney General William Barr said in joint statement on Nov. 5.

Yet many state and local jurisdictions, like Northampton County, are buying a new generation of computerized voting machines ahead of the 2020 presidential election that security experts say are less secure and cost more–about $24 per voter, compared with $12 per voter in jurisdictions using a mix of the two systems, according to the University of Pittsburgh, which analyzed costs in Pennsylvania.

The Election Systems & Software building in Omaha on July 18, 2018. *Photographer: Nati Harnik/AP Photo*

After the failure in Northampton, ES&S apologized and assured voters that the results were accurate. "At this point, ES&S has not determined root cause of the reporting issue and is working closely with the state and county to conduct a thorough investigation, including a review of the machines," the Omaha-based company said.

Cybersecurity experts are baffled by local election officials choosing the computerized voting machines. "It's a mystery to me," said Rich DeMillo, a Georgia Tech computer science professor and former Hewlett-Packard chief technology officer. "Does someone have 8 x 10 glossies? No one has been able to figure out the behavior of elections officials. It's like they all drink the same Kool-Aid."

The animus is mutual. At conferences, election administrators swap complaints about cyber experts treating them like idiots, said Dana DeBeauvoir, head of elections in Travis County, Texas, whose office purchased a computerized system DeMillo deplores. Hand-marked ballots are "a supremely horrible idea" cooked up by people in Washington "who have never had to really conduct an election," she said.

Election machines are just one way hackers could try to infiltrate an election to change the vote or undermine its credibility. They also could corrupt voter registration rolls or lock up the computers of voting officials with ransomware. Only in the case of voting machines, though, does the safest technology also happen to be simpler and cheaper.

"These elaborate election systems benefit companies' bottom line far more than the

taxpayers and voters paying for them"

It's an argument that has barely budged the voting-machinery market. By 2020, the use of paper ballots with scanners is set to increase by about 2% since the last presidential election, while devices with a touch-screen component have dropped .2% across precincts, according to data compiled by the Verified Voting Foundation, a non-profit focused on election transparency and best practices.

Paper ballots are marked with a writing utensil before being fed into a scanner. The more expensive ballot-marking devices use touchscreens to produce a paper record that the voter may review before putting into a scanner for tabulation.

Neither method is entirely safe, as the scanner tallying paper ballots could be breached. But cybersecurity experts argue that the computerized model is riskier, because a hacked or buggy ballot marker could contaminate the paper record needed to audit results. A voter marking a ballot by hand could spoil his own but no one else's. With ballot computers, it's up to the voter to catch and report errors in the receipt, and many don't do that, according to a study DeMillo published in December. If authorities find a machine is at fault, the only fix is a new election, because the paper record is ruined.

Senator Richard Burr, Republican chairman of the Senate Intelligence Committee, right, speaks during a news conference previewing the panel's findings on Russian election meddling on March 20, 2018. *Photographer: Toya Sarno Jordan/Bloomberg*

In a report on Russian election meddling, the Senate Intelligence Committee voiced support for paper ballots and optical scanners, calling them "the least vulnerable to cyber attack."

Winning over the nation's election administrators to that point of view is no simple task. They are splintered among thousands of state and local governments and often lobbied by privately held election companies anxious for sales, as taxpayers tend to pay for new voting equipment only once a decade.

Decision makers include state officials in some states and local ones in most. Some of those officials have other duties, like approving zoning permits and marriage licenses or, in Texas, cattle brands. Some have technical expertise. Some do not.

Familiarity, practicality, professional relationships and campaign money compete with security concerns when purchasing decisions are made.

"There's no reason to believe that the paper trail generated by the XL accurately reflects voters' selections"

In Philadelphia, a three-person election commission discounted cybersecurity warnings and, in February, selected ExpressVote XL from ES&S after a massive lobbying effort. It has a 32-inch touchscreen at a cost of $29 million, or $27.59 per voter, not including roughly $3.8 million over 10 years in fees.

But the decision raised suspicions. State Auditor General Eugene DePasquale noted that the request for proposals appeared to favor equipment of the XL's type and size. An investigation by City Controller Rebecca Rhynhart later found that ES&S had courted the tiny commission for six years, spending almost half a million dollars lobbying it. The company paid a $2.9 million penalty–the highest in Philadelphia history–for failing to disclose lobbying on bid documents, according to the city controller's office.

The company acknowledged that it erred by failing to register its lobbyists, saying it was due to a flawed interpretation of the city's procurement provisions. But the company's "inadvertent omission in no way impacted the RFP process," according to an ES&S statement on Aug. 15.

Asked this week about the relative security of the hand-marked or computer-marked ballots, an ES&S spokeswoman said they are both very secure. "In either instance, votes are counted via technology, and both use human-readable paper records for audit purposes," Katina Granger said in an emailed statement in which she noted that computer ballot markers also are easier for the disabled to use.

Mac Beeson, Regional Sales Manager at Election Systems & Software, demonstrates the ExpressVote digital voting machines in Raleigh, N.C. on Aug. 16, 2019. *Photographer: Allen G. Breed/AP Photo*

In North Carolina, the state elections board initially decided against allowing counties to buy digital-voting machines like ExpressVote after hearing arguments "that simpler is better and that hand-marked paper ballots were the gold standard," said board member Stella Anderson. Then one member asked to change his vote, and a second quit in an uproar after making an offensive joke in a speech.

The new state elections chairman, Damon Circosta, replaced him. In August, he cast the deciding vote certifying ES&S's ExpressVote and later said many voters prefer the familiarity of touchscreens. "The challenge we have with the cyber advocates who are laser focused on the ballot-marking devices is that they can't see the forest for the trees," Circosta said in an interview.

After last week's fiasco in Northampton, opponents of the county's decision to buy the ExpressVote system were saying I told you so. "The local elections administrators just fell in love with these machines," said Deb Hunter, a school teacher who served on the board that selected the XL system from ES&S, the dominant player in the industry. She had pushed for hand-marked paper ballots. "This administration just railroaded this."

Eric Coomer from Dominion Voting demonstrates his company's touch screen tablet in Georgia on Aug. 30, 2018. *Photographer: Bob Andres/Atlanta Journal-Constitution via AP Photo*

ES&S and several other manufacturers said they aren't in the business of telling election administrators what to buy but rather are simply offering options of varying price ranges and technological abilities. Some favor the more expensive electronic models because voters are comfortable with using a touchscreen, they said.

Computer-voting's defenders say there's never been proof hacking has altered an election's result, which is true, and that computers can't be compromised if not connected to the internet, which is not. They also note that the systems all but eliminate human error by not allowing voters to mark more than one candidate in a race, for instance. (Modern scanners also reject such 'overvotes' on hand-marked ballots.)

David Becker, founder of the Center for Election Innovation & Research in Washington, argued that the machines are safe and that complaints "are more heat than light, fueled by activism and anger and social media."

But Susan Greenhalgh, vice president at the National Election Defense Coalition, said too many election officials have been convinced by vendors and colleagues that spending more money and deploying more technology will result in a better, safer election.

"That isn't always true," said Greenhalgh, whose group advocates for better election security. "These elaborate election systems benefit companies' bottom line far more than the taxpayers and voters paying for them."

In Northampton, election officials said the silver lining was that the system allowed the flawed initial results to be checked.

But the paper record they're counting on isn't reliable, said Philip Stark, a University of California-Berkeley statistics professor who invented the kind of post-election audit that security experts say is needed. "There's no reason to believe that the paper trail generated by the XL accurately reflects voters' selections," he said.

Northampton Republicans are no less skeptical. Lee Snover, the local party chairwoman, said the results can't be trusted and the experience has shaken voters' trust going into 2020. "We think voters were disenfranchised," she said. "I actually supported these machines, but I had no idea they could be so flawed. I think we were better off the old-fashioned way."

In another echo of Bush v. Gore, local Republicans sent for investigators from the Republican National Committee: The party is considering a lawsuit against the county and ES&S, which has apologized for the snafu.

The only solution, Snover said, is to conduct another election with–wait for it–punch-card paper ballots.

In this article

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1,461.20   USD/t oz.   ▼ -2.60   -0.18%

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Exhibit J

From:	Gates, Timothy
To:	Ilann M. Maazel
Subject:	RE: [External] RE: Request
Date:	Wednesday, November 13, 2019 1:48:40 PM

Ilann –

I appreciate the follow-up; however, our position remains that ES&S ExpressVote XL fully complies with Section 2 of the Settlement Agreement.

--Tim

From: Ilann M. Maazel <imaazel@ecbalaw.com>
Sent: Sunday, November 10, 2019 3:04 PM
To: Gates, Timothy <tgates@pa.gov>
Subject: [External] RE: Request

ATTENTION: *This email message is from an external sender. Do not open links or attachments from unknown sources. To report suspicious email, forward the message as an attachment to* CWOPA_SPAM@pa.gov*.*

Thanks, Tim.

Are you willing to reconsider your position in light of the ES&S disaster in Northampton County last Tuesday? This system is not worthy of Pennsylvania voters or our settlement agreement. (And just imagine if its failures were not so colossal – would anyone have even noticed?)

Ilann M. Maazel
Partner
Emery Celli Brinckerhoff & Abady LLP
600 Fifth Avenue at Rockefeller Center, 10th Floor
New York, NY 10020
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From: Gates, Timothy <tgates@pa.gov>
Sent: Friday, November 8, 2019 4:58 PM
To: Ilann M. Maazel <imaazel@ecbalaw.com>
Subject: Request

Ilann,

During our call earlier this week you asked a question regarding contact between the printer head and the vote summary card. Our response is as follows: During the examination of the system it was observed that the only time the printer head makes contact with the vote summary card is after the candidate selections are made. After the selections are burned onto the thermal paper, the printer head lifts and allows the voter verified record to pass to the collection bin without making contact with the printer head.

You also asked about an under-vote scenario and whether or not the voter-verifiable record reflects that the voter did not select a candidate for a race. We have confirmed that the text portion of the vote summary card does not leave spaces for the printing of additional votes. In addition, the barcode section of the vote summary card protects against the addition or alteration of barcodes through the use of checksums.

Have a great weekend.

--Tim

Timothy E. Gates | Chief Counsel
PA Department of State | Office of Chief Counsel
306 North Office Building | Harrisburg, PA 17120
Phone: 717.783.0736 | Fax: 717.214.9899
www.dos.state.pa.us

Exhibit K

Colorado
Secretary of State
Jena Griswold

Menu

News Release

**State of Colorado
Department of State**
1700 Broadway
Suite 250
Denver, CO 80290

Jena Griswold
Secretary of State

Jenny Flanagan
Deputy Secretary of State

Media contact
303-860-6903
Serena Woods - serena.woods@sos.state.co.us

Colorado Secretary of State Takes Action to Increase Cyber Security, Announces Initiative to Remove QR Codes from Ballots

Denver, September 16, 2019 – Colorado Secretary of State Jena Griswold announced that Colorado will stop using ballots with QR codes. The removal of QR codes will increase the security of vote tabulation and ensure voters can accurately verify that their ballots are correctly marked. With foreign countries actively trying to exploit voting vulnerabilities, this is a first-in-the nation added security measure.

"I am proud that Colorado continues to lead the nation in election cybersecurity," said Secretary of State Jena Griswold. "Voters should have the utmost confidence that their vote will count. Removing QR codes from ballots will enable voters to see for themselves that their ballots are correct and helps guard against cyber meddling."

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Colorado will be the first state to require voting systems to tabulate all ballots using only human-verifiable information and not QR codes. Because of this initiative, an enhanced system is being developed and it will be tested and certified before it is deployed starting after the 2020 election. Once fully implemented, all ballots voted in Colorado will be tabulated using the marked ovals on the ballot rather than information from a QR code.

The U.S. intelligence community has concluded that Russian operatives executed a campaign to influence the outcome of the 2016 Presidential Election, and warns that efforts will continue in the future. Cybersecurity experts and election integrity advocates have raised questions about the security and verifiability of paper ballots containing a QR code. Secretary Griswold is proactively leading the nation to reduce future vulnerabilities.

"We live in a constantly changing threat environment. Hostile actors will continue their efforts to discover vulnerabilities in the attempt to undermine confidence in our elections. We must continually assess all election systems to identify areas that should be improved. Our adversaries are not standing still, and neither can we," continued Secretary Griswold.

Currently, when a Coloradan votes at a polling location, they may use a ballot marking device that prints a paper ballot that displays both the voter's choices and a QR code embedded with the voter's choices. Although voters can see their vote choices, they cannot verify that the QR code is correct. These ballots are tabulated by machines that decode the votes contained in the QR code. QR codes could be among the next target of an attack and are potentially subject to manipulation. Colorado will be the first state to require ballots from ballot marking devices to be tabulated using only human-verifiable information and not QR codes.

Unlike Colorado, many states do not have safeguards built in to catch manipulations. Colorado is the only state to have successfully conducted a statewide risk-limiting audit, in which bipartisan teams count randomly selected ballots and compare those results to the machine tallies of the same ballots. This statistically-proven method allows Coloradans to have confidence in our state's election outcomes and guards against QR code manipulation.

There is no evidence that any of Colorado's voting systems have been targeted or attacked by malicious actors. By design, in Colorado the computers and devices that mark and count ballots and votes are completely independent from online systems. Colorado prohibits voting system components from being directly or indirectly connected to the internet, and imposes multiple layers of security to ensure that threats are not spread to a tabulation system by other means.

Secretary Griswold's decision to move away from QR codes furthers Colorado's status as the safest state in the nation to cast a ballot.

# # #

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Exhibit L

Election Terms Glossary - Draft

> This glossary contains election terms including those to be used in the next VVSG requirements
> and glossary and in the Common
> Data Format specifications. The glossary is being built via a joint effort by The Democracy F
> und, the VVSG Election Modeling
> public working group, NIST, and other individuals in the election community.

VVSGTerm Glossary

absentee ballot

Ballot used for absentee voting.

#vvsg

absentee voting

Voting that can occur unsupervised at a location chosen by the voter either before or on election day.

#vvsg

acceptance testing

Examination of a voting system and by the purchasing election jurisdiction to validate:

- the performance of delivered devices to ensure they meet procurement requirements, and
- that the delivered system is, in fact, the certified system purchased. This usually happens in a simulated-use environment.

#vvsg

access control

The process of granting or denying specific requests to:

- obtain and use information and related information processing services; and
- enter specific physical facilities.

#vvsg

accessibility

Measurable characteristics that indicate the degree to which a system is available to, and usable by, individuals with disabilities. The most common disabilities include those associated with vision, hearing, mobility, and cognition.

#vvsg

accreditation

Formal recognition that a laboratory is competent to carry out specific tests or calibrations.

#vvsg

accreditation body

1. Authoritative body that provides accreditation.
2. Independent organization responsible for
   - assessing the performance of other organizations against a recognized standard, and
   - formally confirming the status of those that meet the standard.

#vvsg

activation device

Programmed device that creates credentials necessary to begin a voting session using a specific ballot style. Examples include electronic poll books and card activators that contain credential information necessary to determine the appropriate ballot style for the voter.

#vvsg

active period

Span of time during which a vote-capture device either is ready to begin a voting session or is in use during a voting session.

#vvsg

adjudication

Process of resolving flagged cast ballots to reflect voter intent. Common reasons for flagging include:

- write-ins,
- overvotes,
- marginal marks,
- having no contest selections marked on the entire ballot, or
- the ballot being unreadable by a scanner.

#vvsg

adjudication-required ballot

A ballot that contains contest selections that require adjudication.

#vvsg

affiliation

Association with a political party.

#vvsg

air gap

A physical separation between systems that requires data to be moved by some external, manual procedure.

#vvsg

alert time

The amount of time that a voting device will wait for detectible voter activity after issuing an alert, before going into an inactive state requiring election official intervention.

#vvsg

alternative format

The ballot or accompanying information is said to be in an alternative format if it is presented in non-standard ballot language and format. Examples include, but are not limited to, languages other than English, Braille, ASCII text, large print, recorded audio.

#vvsg

appropriate mark

An expected mark made according to the ballot marking instructions.

#vvsg

approval voting

A vote variation used for elections in which each voter may "approve" of (that is, select) any number of candidates. Typically, the winner is the most-approved candidate.

#vvsg

archival media

Media that designed to preserve content for an extended period of time with minimal data corruption or loss.

#vvsg

assistive technology

A device that improves or maintains the capabilities of people with disabilities (such as no vision, low vision, mobility, or cognitive). These devices include headsets, keypads, software, sip-and-puff, and voice synthesizers.

#vvsg

asymmetric cryptography

Encryption system that uses a public and private key pair for cryptographic operation. The private key is generally stored in a user's digital certificate and used typically to encrypt or digitally sign data. The public key is used typically to decrypt the data or verify its digital signatures. The keys could be used interchangeably as needed, that is, a public key can be used to encrypt data and the private key can be used to decrypt the data.

#vvsg

audio format

A ballot display format in which contest options and other information are communicated through sound and speech.

#vvsg

audit

1. Systematic, independent, documented process for obtaining records, statements of fact, or other relevant information and assessing them objectively to determine the extent to which specified requirements are fulfilled.
2. Verification of statistical or exact agreement of records from different processes or subsystems of a voting system.
3. A review of a system and its controls to determine its operational status and the accuracy of its outputs.

#vvsg

audit device

Voting device dedicated exclusively to independently verifying or assessing the voting system's performance.

#vvsg

audit trail

Information recorded during election activities to reconstruct steps followed or to later verify actions taken with respect to the voting system.

#vvsg

authentication

Verifying the identity of a user, process, or device, often as a prerequisite to allowing access to resources in an information system. Audit trails may include event logs, paper records, error messages, and reports.

#vvsg

ballot

Presentation of the contest options for a particular voter.

#vvsg

ballot counting logic

The software logic that

- defines the combinations of contest selections that are valid and invalid on a given ballot and,
- determines how the contest selections are totaled in a given election.

#vvsg

ballot data

A list of contests and associated options that may appear on a ballot for a particular election.

#vvsg

ballot display format

The concrete presentation of the contents of a ballot appropriate to the particular voting technology being used. The contents may be rendered using various methods of presentation (visual or audio), language, or graphics.

#vvsg

ballot image

Electronically produced record of all votes cast by a single voter. A ballot image might be a transient logical representation of the votes or an archival record (a cast vote record).

#vvsg

ballot instructions

Information provided to the voter that describes the procedure for marking the ballot. This information may appear directly on the paper or electronic ballot or may be provided separately.

#vvsg

ballot manifest

A catalog prepared by election officials listing all the physical paper ballots and their locations in sequence.

#vvsg

ballot marking device

A device that:

- permits contest options to be reviewed on an electronic interface,
- produces a human-readable paper ballot, and
- does not make any other lasting record of the voter's selections.

#vvsg

ballot measure

A question that appears on a ballot with options, usually in the form of an approval or rejection.

#vvsg

ballot measure option

A contest option that specifies a response to a ballot measure.

#vvsg

ballot on demandÂ®

A process that produces a paper ballot of the required ballot style that meets a specific voter's needs. The use of this process requires:

- a system with a printer that can create a tabulatable paper ballot; and
- a device driving the printer that has all the data needed to print each ballot style and allows selection of the needed style. Note: "ballot on demand" is a registered trademark of ES&S.

#vvsg

ballot production

Process of generating ballots for presentation to voters, for example, printing paper ballots or configuring the ballot presentation for an electronic display.

#vvsg

ballot rotation

The process of varying the order of listed candidates within a contest. This allows each candidate to appear first on the list of candidates an approximately equal number of times across different ballot styles or jurisdictions.

#vvsg

ballot style

Ballot data that has been put into contest order for a particular precinct and considers a particular set of voter situations. Voter situations include party affiliation (for closed primaries), and age of the voter (in states that permit 17-year-olds to vote in primary elections), among others.

#vvsg

barcode

An optical, machine-readable representation of data as a sequence of bars and spaces that conform to accepted standards. Linear (1d) barcode standards include UPC, EAN and 128. QR is an example of a 2d barcode standard.

#vvsg

barcode reader

Device used to scan barcodes and convert the encoded information into a usable format. Barcode readers are used to scan codes on a variety of election materials including ballots, driver's licenses, voter ID cards, voter information packets, envelopes, and other election documents.

#vvsg

batch

A collection of paper ballots gathered as a group for tabulation or for auditing.

#vvsg

batch fed scanner

An electronic voting device that:

- accepts stacks of hand-marked or BMD-produced paper ballots and automatically processes them until the stack is empty;
- is usually used at an election jurisdiction's central location;
- is mostly commonly used to process absentee or mail ballots;
- usually has input and output hoppers for ballots;
- scans a ballot and rejects it if either unreadable or un-processable;
- detects, interprets, and validates contest selections;
- detects and sorts (either digitally or physically) ballots that are unreadable or un-processable, or that contain undeterminable selections, marking exceptions, or write-ins; and
- tabulates and reports contest results as required. This unit was previously referred to as central count optical scanner or CCOS.

#vvsg

benchmark

Quantitative point of reference to which the measured performance of a system or device may be compared.

#vvsg

blank ballot

An issued ballot without any selections made.

#vvsg

callable unit

(Of a software program or analogous logical design) Function, method, operation, subroutine, procedure, or analogous structural unit that appears within a module.

#vvsg

candidate

Person contending in a contest for office. A candidate may be explicitly presented as one of the contest options or may be a write-in candidate.

#vvsg

candidate option

A contest option that is associated with a candidate.

#vvsg

canvass

The process of compiling, reviewing, and validating election returns that forms the basis of the official results by a political subdivision.

#vvsg

cast

(v) The final action a voter takes in selecting contest options and irrevocably confirming their intent to vote as selected.

#vvsg

cast ballot

Ballot in which the voter has taken final action in selecting contest options and irrevocably confirmed their intent to vote as selected.

#vvsg

cast vote record

Archival tabulatable record of all votes produced by a single voter from a given ballot.

#vvsg

central reporting device

Electronic voting device that consolidates and reports vote totals from multiple precincts at a central location.

#vvsg

certification testing

Testing of a voting system performed by a testing authority (such as the EAC or a state) to ensure that the system meets the requirements defined in the standards being tested against in the manner specified in its product documentation.

#vvsg

Ciphertext

Data or information in its encrypted form.

#vvsg

closed primary

Partisan primary election in which the voter receives a ballot containing only those party-specific contests pertaining to the political party with which the voter is affiliated, along with non-party-specific contests presented at the same election. Unaffiliated voters may be permitted to vote only on non-party-specific contests.

#vvsg

combined precinct

Two or more precincts treated as a single precinct for a specific election.

#vvsg

commercial-off-the-shelf

Hardware or software components that are widely available for purchase and can be integrated into special-purpose systems.

#vvsg

Common Data Format

Standard and practice of creating and storing data in a common, described format that can be read by other systems.

#vvsg

Common Industry Format

Format used for usability test reporting. The format is described in ISO/IEC 25062:2006 "Common Industry Format (CIF) for Usability Test Reports," one of a group of usability standards. CIF is the format required for usability test reporting.

#vvsg

component

Element within a larger voting system.

#vvsg

confidentiality

Prevention of unauthorized disclosure of information.

#vvsg

configuration management

A continuous process of recording and maintaining consistent and reliable records pertaining to an organization's hardware and software composition, including software version control and hardwareupdates.

#vvsg

conformance

Fulfilling specified requirements by a product, process, or service.

#vvsg

conformance testing

Process of testing device or system of devices against the requirements specified in one or more standards. The outcomes of a conformance test are generally a pass or fail result, possibly including reports of problems encountered during the execution.

#vvsg

contest

A single decision or set of associated decisions being put before the voters (for example, the option of candidates to fill a particular public office or the approval or disapproval of a constitutional amendment). This term encompasses other terms such as "race," "question," and "issue" that are sometimes used to refer to specific kinds of contests. It does not refer to the legal challenge of an election outcome.

#vvsg

contest option

A votable choice that appears under a contest.

#vvsg

contest option position

A specified area on a ballot where a voter's selection in a particular contest can be indicated.

#vvsg

contest option vote

Vote that will be counted for a particular contest option. This term was previously referred to as valid vote.

#vvsg

contest selection

A selection made on the ballot by a voter with respect to a specific single contest (for example, a candidate, the value "Yes" or "Approve").

#vvsg

core logic

Subset of application logic that is responsible for vote recording and tabulation.

#vvsg

corrective action

Action taken to eliminate the causes of an existing deficiency or other undesirable situation in order to prevent it from recurring.

#vvsg

counted ballot

A read ballot that has been processed and whose votes are included in the vote totals.

#vvsg

cross-party endorsement

Endorsement of a single candidate or slate of candidates by more than one political party. The candidate or slate appears on the ballot representing each endorsing political party.

#vvsg

cryptographic end-to-end voting system

A voting system that supports both voter verification and election verification.

#vvsg

cryptographic hash

A cryptographic algorithm that computes a numerical value based on a data file or electronic message. The numerical value is used to represent that file or message, and depends on the entire contents of the file or message. A hash function can be considered to be a fingerprint of the file or message. Colloquially known as a hash, hash function, or digital fingerprint. Hashes provide integrity protection.

#vvsg

cryptographic key

A numeric value used as input to cryptographic operations, such as decryption, encryption, signature generation, or verification of a ditigal signature.

#vvsg

cryptography

Discipline that embodies the principles, means, and methods for transforming data to hide their semantic content, prevent their unauthorized use, prevent their undetected modification, or establish their authenticity.

#vvsg

cumulative voting

A vote variation used in multi-seat contests where a voter is permitted to distribute allowed selections to 1 or more candidates in whole vote increments.

#vvsg

cybersecurity

Measures taken to protect computer systems and data from attack and unauthorized access or use.

#vvsg

decertification

Revocation of national or state certification of a voting system or any of its components.

#vvsg

decryption

Cryptographic process of transforming encrypted data back into its pre-encryption form.

#vvsg

defense-in-depth

Also called the "Castle" approach. Multiple levels of logical and physical security measures that deny a single point of security failure in a system. Examples include the combined use of passwords, encryption, lock-and-key access, security seals, and logs.

#vvsg

device

Physical apparatus and any supporting supplies, materials, and logic that together form a functional unit that performs assigned tasks as an integrated whole.

#vvsg

digital certificate

A data set used to identify the holder of the certification and to verify, using a PKI, the authenticity of the certificate. It typically includes the holder's private key and is used for cryptographic operations such as digitally signing or encrypting data.

#vvsg

digital signature

A cryptographic operation where the private key is used to digitally sign an electronic document and the public key is used to verify the signature. Digital signatures provide data authentication and integrity protection.

#vvsg

direct recording electronic voting machine

A vote-capture device that allows:

- electronic presentation of a ballot,
- electronic selection of valid contest options, and
- electronic storage of contest selections as individual records. It also provides a summary of these contest selections.

#vvsg

dynamic password

A password that changes at a defined interval or event.

#vvsg

EAC

Election Assistance Commission, created by the Help America Vote Act (HAVA) to assist the states regarding HAVA compliance and to distribute HAVA funds to the states. The EAC is also charged with creating voting system guidelines and operating the federal government's first voting systemcertification program. The EAC is also responsible for maintaining the National Voter Registration form, conducting research, and administering a national clearinghouse on elections that includes shared practices, information for voters, and other resources to improve elections.

#vvsg

early voting

Voting that occurs prior to election day under the supervision of election workers.

#vvsg

early voting center

Physical location where individuals may cast a ballot before election day under the supervision of election workers.

#vvsg

elected office

An office that is filled primarily or exclusively via election.

#vvsg

election

A formal process in which qualified voters select candidates to fill seats in one or more officesand/or vote on one or more proposed ballot measures.

#vvsg

election certification

The act of confirming the final official results of a jurisdiction's election. This event occurs after results from valid ballots are tallied from all sources (election day, absentee, early vote, provisional, etc.) and results are validated and approved by those legally responsible.

#vvsg

election day

The last day on which voters may cast a ballot. Absentee votes and early votes may be cast in advance of election day.

#vvsg

election definition

Data used in defining an election, including election districts, contests, candidates, and ballot styleinformation.

#vvsg

election definition medium

Programmed memory device containing all applicable election definition data required by the election system component where the device will be used.

#vvsg

election district

Administrative area in which voters are entitled to vote in contests that are specific to that area.

#vvsg

election jurisdiction

A geographical area to which a practical authority has been granted to administer elections for political or administrative offices. Areas of jurisdiction apply to local, state, and federal levels. States, counties, cities, towns, and townships are all examples of jurisdictions.

#vvsg

election management system

Set of processing functions and databases within a voting system typically used to:

- develop and maintain election definition data,
- perform ballot layout functions,
- create ballot presentation templates for ballot printers or devices used by voters for ballotmarkup,
- count votes,
- consolidate and report results, and
- maintain audit trails.

#vvsg

election official

Any person who is involved with administering or conducting an election, including government personnel and temporary election workers. This may include any county clerk and recorder, electionjudge, member of a canvassing board, central election official, election day worker, member of a board of county commissioners, member or secretary of a board of directors authorized to conduct public elections, representative of a governing body, or other person engaged in the performance of election duties as required by the election code.

#vvsg

election programming

Process by which election officials or their designees use voting system software to create the election definition and configure all election definition media for use in a specific election.

#vvsg

Election Results Reporting System

A system that:

- aggregates and displays election results across the jurisdiction,
- can be real-time or near real-time,
- can provide a variety of formats for displaying election results, and
- may provide direct feeds for the media.

#vvsg

election system

1. A technology-based system that is used to collect, process, and store data related to electionsand election administration. In addition to voter registration systems and public electionwebsites, election systems include voting systems (the means through which voters cast their ballots), vote tabulation systems, election night reporting systems, and auditing systems.
2. Entire array of procedures, people, resources, equipment, and locations associated with conducting elections.

#vvsg

election worker

Any person who interacts with those coming to vote. This includes any poll worker, election day worker, early voting worker, or other temporary staff engaged in supporting the voting or vote counting process.

#vvsg

electronic ballot delivery

The delivery of ballot and voter information packets electronically. The MOVE Act requires each state to provide for the electronic delivery (via fax, email, or an Internet-supported application) of ballots and related information from the local election office to the registered, UOCAVA voter.

#vvsg

electronic ballot interface

Subsystem within a voting system which communicates ballot information to a voter in video, audio, or other alternative format which allows the voter to select contest options using vocalization or physical actions.

#vvsg

electronic ballot return

The return of a voted ballot or voter information packet using electronic means. This can be by fax, email, or through the use of an Internet supported application. Sometimes referred to as "Internet Voting."

#vvsg

electronic device

Device that uses electronic or electromechanical components.

#vvsg

electronic poll book

Device that partially automates the process of checking in voters, assigning them the correct ballot style, and marking voters who have been issued a ballot. May be used in place of a traditional paper poll book. E-poll books can be stand alone at the precinct with a separate copy of the registration list or can be networked into a central voter registration system. They can check and update voter records in real time.

#vvsg

electronic voter interface

Component of an electronic vote-capture device that communicates ballot information to the voterand accepts contest selection input from the voter.

#vvsg

eligible voters

The universe of all voters who, if they cast a ballot, would have the legal right to have eligible contests on that ballot counted. This would include those who do not appear in the list of eligible voters because they live in a same-day registration or no registration state and did not or could not register ahead of time.

#vvsg

encryption

Cryptographic process of transforming data (called "plaintext") into a form (called "ciphertext") that conceals the data's original meaning to prevent it from being known or used. Encryption provides confidentiality protection.

#vvsg

endorsement

Approval by a political party, for example, as the candidate that the party fields in a particular contestor as the candidate that should receive straight party votes. In some states, more than one party may endorse a candidate or contest option.

#vvsg

enhanced visual format

An alternative visual display format supporting personal choices such as text size, color contrast, and preferred language.

#vvsg

error correction code

Coding system that allows data being read or transmitted to be checked for errors and, when detected, corrects those errors.

#vvsg

error rate

Ratio of the number of errors that occur to the volume of data processed.

#vvsg

escalation of privilege

An attack on a system where the attacker is using some means to bypass security controls in order to attain a higher privilege level on the target system.

#vvsg

exhausted ballot

Refers to processing a ranked choice voting contest on a cast ballot, when that ballot becomes inactive and cannot be advanced in the tabulation for a contest because there are no further valid rankings on the ballot for continuing contest options.

#vvsg

expected mark

Mark that falls wholly or partially inside a contest selection position.

#vvsg

Extensible Markup Language

A text-based language used to organize and present information on the World Wide Web.

#vvsg

extraneous mark

A mark on a paper ballot that appears to be unrelated to the act of indicating a voter's selection. Examples include: a mark made unintentionally by a voter that is obviously not related to making a selection; a hesitation mark, a dot within or outside of the target area made by resting a pen or pencil on the ballot; written notes or identifying information not related to indication of the voter's selection; or printing defects.

#vvsg

failure

Looking at voting system reliability, a failure is an event that results in:

- loss of one or more functions,
- degradation of performance resulting in a device that is unable to perform its intended function for longer than 10 seconds,
- automatic reset, restart, or reboot of the voting device, operating system or application software, requiring an unanticipated intervention by a person in the role of election worker or technician before normal operation can continue, or
- error messages or audit log entries indicating that a failure has occurred.

#vvsg

failure rate

Ratio of the number of failures that occur to the volume of data processed.

#vvsg

fault

Flaw in design or implementation that may result in the qualities or behavior of the voting system deviating from the qualities or behavior that are anticipated, including those specified in the VVSG or in manufacturer-provided documentation.

#vvsg

fault-tolerant

A system that continues to operate after the failure of a computer or network component.

#vvsg

Federal Information Processing Standards

Standards for federal computer systems developed by NIST. These standards are developed when there are no existing industry standards to address federal requirements for system interoperability, portability of data and software, and computer security.

#vvsg

finding

(n) Result of a formal evaluation by a test lab or accredited expert.

#vvsg

firewall

A gateway system designed to prevent unauthorized access to a private network or intranet that is connected to the internet. A firewall can be implemented in either hardware or software, or a combination of both.

#vvsg

firmware

A specific class of software encoded directly into a hardware device that controls its defined functions and provides the low-level control for the computer's specific hardware (such as the firmware that initially boots an operating system).

#vvsg

Functional Configuration Audit

Exhaustive verification of every system function and combination of functions cited in the manufacturer's documentation. The FCA verifies the accuracy and completeness of the system's Voter Manual, Operations Procedures, Maintenance Procedures, and Diagnostic Testing Procedures.

#vvsg

functional test

Test performed to verify or validate the accomplishment of one or more functions.

Election Terms Glossary 11/26

#vvsg

general election

Election in which all eligible voters, regardless of party affiliation, are permitted to select candidates to fill public office and/or vote on ballot measures.

#vvsg

Geographical Information System

A system designed to capture, store, manipulate, analyze, manage, and present all types of spatial or geographical data. GIS systems are used to validate voting district boundaries and may be integrated with the voter registration system.

#vvsg

Geopolitical Unit

Describes units of geopolitical geography so that they can be associated with contests, offices, ballot styles, and election results.

#vvsg

hardware

The physical, tangible, mechanical, or electromechanical components of a system.

#vvsg

Help America Vote Act

Act passed by the U.S. Congress in 2002 to make sweeping reforms to the nation's voting process. HAVA addresses improvements to voting systems and voter access that were identified following the 2000 election.

#vvsg

implementation statement

Statement by a manufacturer indicating the capabilities, features, and optional functions as well as extensions that have been implemented. Also known as implementation conformance statement.

#vvsg

in-person voting

Voting that occurs in an official location under the supervision of election officials.

#vvsg

independently

Without assistance from an election official or other person.

#vvsg

indirect selection

The mechanism by which a selection for a specific contest option automatically selects other linked contest options. An example is a straight party selection that causes indirect selections for all contest options of the identified party.

#vvsg

information security

Protecting information and information systems from unauthorized access, use, disclosure, disruption, modification, or destruction in order to provide integrity, confidentiality, and availability.

#vvsg

inspection

Examination of a product design, product, process, or installation and determination of its conformity with specific requirements.

#vvsg

interaction mode

A specific combination of display format and control or navigation options that enable voters to perceive and interact with the voting system.

#vvsg

interoperability

The extent to which systems from different manufacturers and devices with different system configurations can communicate with each other.

#vvsg

Intrusion Detection System

A hardware or software application that detects and reports a suspected security breach, policy violation, or other compromise that may adversely affect the network.

#vvsg

Intrusion Prevention System

A hardware or software application that detects and blocks a suspected security breach, policy violation or other compromise that may adversely affect the network.

#vvsg

key management

Activities involving handling of cryptographic keys and other related security parameters (such as passwords) during the entire life cycle of the keys, including their generation, storage, establishment, entry and output, zeroization, and revocation.

#vvsg

life cycle

Systems engineering concept that identifies the phases that a system passes through, from concept to retirement. There are different concerns and activities associated with each phase of the life cycle.

#vvsg

locality

Generic term used in election contexts to signify a jurisdiction such as a town, village or city contained within a jurisdiction administering an election, such as a county.

#vvsg

logic and accuracy testing

Equipment and system readiness tests whose purpose is to detect malfunctioning devices and improper election-specific setup before the equipment or systems are used in an election. Electionpersonnel conduct L&A tests prior to the start of an election as part of the process of setting up the system and the devices for an election according to jurisdiction practices and conforming to any state laws.

#vvsg

logic defect

Fault in software, firmware, or hardwired logic.

#vvsg

logical correctness

Condition signifying that, for a given input, a computer program will satisfy the program specification and produce the required output.

#vvsg

low/no dexterity mode

An interaction mode with accessibility features for voters with no use of one or both hands or low dexterity.

#vvsg

machine unreadable mark

Mark in a contest selection position of a paper ballot that cannot be detected as readable or marginal by a scanner, and may require human adjudication.

#vvsg

machine-readable mark

Mark in a contest selection position of a paper ballot that meets requirements for detection by a scanner.

#vvsg

majority voting

A vote variation which requires the winning candidate to receive more than half of the votes cast. If no candidate wins an outright majority, a runoff election may be held between the top two vote-getters.

#vvsg

malware

Software or firmware intended to perform an unauthorized process that will have adverse impact on the confidentiality, integrity, or availability of a system. For example, a virus, worm, Trojan horse, or other code-based entity that infects a host. Spyware and some forms of adware are also examples of malware.

#vvsg

manually-marked paper ballot

Paper ballot marked by a voter using a writing utensil. The paper ballot is the independent voter-verifiable record.

#vvsg

manufacturer

Entity with ownership and control over a voting system submitted for testing.

#vvsg

marginally machine-readable mark

An intentional mark in a contest selection position of a paper ballot that does not meet the requirements for a reliably detectable selection, and therefore requires human adjudication. A marginal mark may be determined to indicate a selection, depending on state law.

#vvsg

marked ballot

Ballot that contains all of a voter's selections.

#vvsg

military voter

A member of a uniformed service in active service, including army, navy, air force, marine corps, coast guard and merchant marine, and their spouses and dependents.

#vvsg

misfeed rate

Ratio of the misfeed total to the total ballot volume.

#vvsg

module

A structural unit of a software program that serves a specific function for the program or that serves to make the program modular in structure for the purposes of easier understanding and maintenance.

#vvsg

multi-factor authentication

Authentication mechanism requiring two or more of the following:

- something you know (such as a password),
- something you have (such as a token),
- something you are (for example, biometric authentication).

#vvsg

multi-seat contest

Contest in which multiple candidates are elected to fill a specified number of seats.

#vvsg

municipality

Term as used in election contexts to signify a jurisdiction such as city, town, or village that has some form of local government for which elections are generally conducted.

#vvsg

N-of-M

Vote variation in which the voter is entitled to allocate a fixed number of votes (N) over a list of M contest options or write-in options, with the constraint that at most 1 vote may be allocated to a given contest option. This usually occurs when multiple seats are concurrently being filled in a

governing body such as a city council or school board where candidates contend for at-large seats. The voter is not obliged to allocate all N votes. 1-of-M is N-of-M voting where N = 1.

#vvsg

national certification test report

Report of the results of independent testing of a voting system by a Voting System Test Lab (VSTL) delivered to the EAC with a recommendation about granting a certification number.

#vvsg

National Institute of Standards and Technology

Federal organization tasked with assisting in the development of voting system standards. NIST develops and maintains standards for a wide array of technologies. NIST scientists assist the EACin developing testable standards for voting systems.

#vvsg

non-party-specific contest

Contest where eligibility to vote in that contest is independent of political party affiliation.

#vvsg

non-user-serviceable failure

Functional failure that requires the manufacturer or highly trained personnel to repair.

#vvsg

nonpartisan office

Elected office for which candidates appear on the ballot without political party designation.

#vvsg

nonpartisan primary

Primary election held to narrow the field of candidates in non-party-specific contests.

#vvsg

nonvolatile memory

Memory in which information can be stored indefinitely with no external power applied.

#vvsg

notice of clarification

Document providing further guidance and explanation on the requirements and procedures of the EAC's Voting System Certification or Voting System Testing Laboratory (VSTL) programs. NOCs may be issued in response to a clarification request from an EAC voting system test laboratory or an EAC registered manufacturer. EAC may also issue NOCs when it determines general clarifications are necessary.

#vvsg

observational test

Operational test conducted on voting devices during an election by real voters to establish confidence that the voter verified paper record is produced correctly when assistive technology is used. Devices subjected to observational testing are used for normal collection of votes; the votescollected are included in the election tally.

#vvsg

office

A position established by law with certain associated rights and duties.

#vvsg

open primary

Partisan primary election in which the voter may choose a political party at the time of voting and vote in party-specific contests associated with that party, along with non-party-specific contestspresented at the same election. Some states require voters to publicly declare their choice of party at the polling place, after which the election worker provides or activates the appropriate ballot. Other states allow the voters to make their choice of party within the privacy of the voting booth.

#vvsg

open source

Computer software with its source code (human readable code) made available with a license in which the copyright holder provides the rights to study, change, and distribute the software to anyone and for any purpose. Open source software may:

- be developed in a collaborative public manner;
- be reviewed by multiple professional and amateur programmers;
- require a fee and be licensed like other software;
- be fully open source or may have only a portion of the software open source.

#vvsg

optical scan

Voting system that counts votes recorded by marks made in contest option positions on the surface of a paper ballot.

#vvsg

overseas voter

A U.S. citizen who is living outside of the United States and is eligible to vote in their last place of residence in the United States.

#vvsg

overvote

Occurs when the number of selections made by a voter in a contest is more than the maximum number allowed.

#vvsg

paper ballot

A piece of paper, or multiple sheets of paper, on which all contest options of a given ballot style are printed.

#vvsg

paper ballot sheet

A single piece of paper that forms part of a paper ballot. Paper ballots may contain multiple ballotsheets.

#vvsg

paper ballot side

The face of a paper ballot sheet. A paper ballot may have two sides.

#vvsg

partisan office

Elected office for which candidates may appear on the ballot with a political party designation.

#vvsg

partisan primary

Primary election held to narrow the field of candidates in party-specific contests.

#vvsg

party-specific contest

Contest where eligibility to vote in that contest is restricted based on political party affiliation or lack of any affiliation. The affiliation might be the registered affiliation of the voter or it might be an affiliation declared at the time of voting.

#vvsg

pattern voting

Selecting contest options across multiple contests in a predetermined pattern intending to signal one's identity to someone else. The possibility of pattern voting can be an issue for publishing Cast Vote Records (CVR) because it may compromise voter privacy if there are enough selections in each published CVR to make it likely a selection pattern might be unique.

#vvsg

penetration testing

An evaluation method that enables researchers to search for vulnerabilities in a system.

#vvsg

personal assistive device

Assistive technology belonging to voters rather than any supplied with the voting system.

#vvsg

Personal Identifiable Information

Any information about an individual maintained by an agency, including:

- information that can be used to distinguish or trace an individual's identity, such as name, social security number, date and place of birth, mother's maiden name, or biometric records; and
- any other information that can be linked to an individual, such as medical, educational, financial, and employment information.

#vvsg

Physical Configuration Audit

Inspection by a voting system test lab (VSTL) that compares the voting system components submitted for certification testing to the manufacturer's technical documentation and confirms that the documentation submitted meets the national certification requirements. Includes witnessing the executable system being built to ensure that the certified release is built from the tested components.

#vvsg

plurality voting

A vote variation in which the candidate with the most votes wins, without necessarily receiving a majority of votes.

#vvsg

political subdivision

Any unit of government, such as counties, cities, school districts, and water and conservation districts having authority to hold elections for public offices or on ballot measures.

#vvsg

polling location

Physical address of a polling place.

#vvsg

polling place

Location at which voters may cast in-person ballots under the supervision of election workers during one or more specific time periods.

#vvsg

post-election audit

Hand-counting votes on paper records, then comparing those counts to the corresponding votecounts originally reported:

- as a check on the accuracy of election results, and
- to resolve discrepancies using accurate hand counts of the paper records as the benchmark.

#vvsg

precinct

Election administration division corresponding to a geographic area that is the basis for determining which contests the voters legally residing in that area are eligible to vote on.

#vvsg

precinct count

Counting ballots in the same precinct in which those ballots have been cast.

#vvsg

precinct split

A subdivision of a precinct which arises when a precinct is split by two or more election districts that may require different ballot styles.

#vvsg

presentable ballot style

Ballot style that includes all presentational details required to generate a ballot. This may include language, ordering of contests and candidates, and structural content such as headers.

#vvsg

presidential primary election

Primary election in which voters choose the delegates to the presidential nominating conventions allotted to their states by the national party committees.

#vvsg

primary election

Election held to determine which candidates qualify to appear as contest options in subsequent elections.

#vvsg

privacy (for voters)

A property of a voting system that is designed and deployed to enable voters to obtain a ballot, and mark, verify, and cast it without revealing their ballot selections or selections of language, display and interaction modes to anyone else. This does not preclude the ability of a voter to request assistance under state law.

#vvsg

private key

The secret part of an asymmetric key pair that is typically used to verify, digitally sign, or decrypt data.

#vvsg

product standard

Standard that specifies requirements to be fulfilled by a product or a group of products, to confirm it can perform its intended task.

#vvsg

programmed device

Electronic device that includes software. Most electronic voting devices include application logic (software) and are, therefore, programmed devices.

#vvsg

proportional voting

A vote variation used in multi-seat contests where the votes allowed in the contest are distributed to the selected candidates proportionally depending on the number of selections. This may result in candidates receiving fractional votes.

#vvsg

provisional ballot

A failsafe ballot provided to a voter whose eligibility for a regular ballot cannot be immediately determined. The ballot may be counted or further processed depending on state law.

#vvsg

public key

Public part of an asymmetric key pair that is typically used to verify digital signatures or encrypt data.

#vvsg

Public Key Infrastructure

A set of roles, policies, and procedures used to establish greater trust in the authenticity of a digital certificate and for use in creating, managing, distributing, using, storing, and revoking digital certificates.

#vvsg

public test

An abbreviated logic and accuracy test of voting equipment, pre-announced in public media and open to public attendance, usually in conformance with specific election calendar timing.

#vvsg

QR Code

Quick Response Code. A 2-D, trademarked bar code. Some voting systems will encode the voter's selections in a QR Code that can be read on a scanner in the precinct and converted to a printed ballot.

#vvsg

range voting

A vote variation for single-seat contests, in which voters give each candidate a score, the scores are added (or averaged), and the candidate with the highest total is elected.

#vvsg

ranked choice voting

A vote variation:

- which allows each voter to rank contest options in order of the voter's preference,
- in which votes are counted in rounds using a series of runoff tabulations to defeat contest options with the fewest votes, and,
- which elects a winner with a majority of final round votes in a single-winner contest and provides proportional representation in multi-winner contests.

#vvsg

read ballot

Cast ballot that has been successfully accepted and initially processed.

#vvsg

recall issue with options

Vote variation that allows voters to remove elected representatives from office before their terms of office expire. The recall may involve not only the question of whether a particular officer should be removed, but also the question of naming a successor in the event that there is an affirmative votefor the recall.

#vvsg

recallable ballot

Recorded ballot that can be individually retrieved and included or excluded from further processing.

#vvsg

recertification

Re-examination, and possibly retesting, of a voting system that was modified after being previously certified. The object of recertification is to determine if the system as modified still conforms to the requirements.

#vvsg

record

(n) Preserved evidence of activities performed or results achieved (for example, forms, reports, testresults). (v) To create a record.

#vvsg

recorded ballot

A ballot for which there is an associated cast vote record.

#vvsg

recount

Repeat tabulation of votes cast in an election, whether manually or electronically, that is used to determine the accuracy of an initial count.

#vvsg

report

Self-contained, time-stamped, archival record, such as a printout or analogous electronic file that is produced at a specific time and subsequently protected from modification.

#vvsg

report total error rate

Ratio of the report total error to the report total volume.

#vvsg

reporting unit

Geographical area in which reported totals or counts are reported (for example, a jurisdiction, precinct, or election district).

#vvsg

reproducibility

Ability to obtain the same test results by using the same test method on identical test items in different testing laboratories with different operators using different equipment.

#vvsg

residual vote

Vote that could not be allocated to a specific contest due to an undervote or overvote.

#vvsg

reviewed ballot

Ballot that has been reviewed (either electronically or by the voter) before it is cast, to determine what contest selections it contains.

#vvsg

risk assessment

The process of identifying the risks to system security and determining the probability of occurrence, the resulting impact, and safeguards that would mitigate this impact.

#vvsg

risk-limiting audit

Procedure for checking a sample of ballots (or voter-verifiable records) that is guaranteed to have a large, pre-specified chance of correcting the reported outcome if the reported outcome is wrong (that is, if a full hand count would reveal an outcome different from the reported outcome).

#vvsg

runoff election

Election to select a winner following a primary or a general election, in which no candidate in the contest received the required minimum percentage of the votes cast. The two candidates receiving the most votes for the contest in question proceed to a runoff election.

#vvsg

seat

An elected office position that a single officeholder may occupy for a term of office.

#vvsg

second chance voting

Feature of a voter facing scanner that reviews the ballot for possible marking mistakes, informs the voter, and presents an opportunity to cast as-is or return the ballot.

#vvsg

security analysis

An inquiry into the potential existence of security flaws in a voting system. Includes an analysis of the system's software, firmware, and hardware, as well as the procedures associated with system development, deployment, operation, and management.

#vvsg

security controls

Management, operational, and technical controls (that is, safeguards or countermeasures) prescribed for an information system to protect the confidentiality, integrity, and availability of the system and its information.

#vvsg

security strength

A metric associated with the amount of work (that is, the number of operations) that is required to break a cryptographic algorithm or system.

#vvsg

software independence

Quality of a voting system or voting device where a previously undetected change or fault in software cannot cause an undetectable change or error in election outcome.

#vvsg

source code

Human readable computer instructions that, when compiled or interpreted, define the functionality of a programmed device. Source code can be written by humans or by computers.

#vvsg

spear phishing

A targeted attack by hackers, using bogus emails, that attempts to get the victim to provide login information or personal information to the hackers. Spear Phishing attempts may appear to originate from legitimate, known sources, such as organizational IT or known vendors.

#vvsg

special election

Primary or general election that is not regularly scheduled. A special election may be combined with a scheduled election.

#vvsg

spoil

(A ballot) To mark or otherwise alter a ballot so it indicates in a human-readable manner that the ballot is not to be cast.

#vvsg

spoiled ballot

A ballot that has been issued to a voter but will not be cast, usually because it has been incorrectly marked or impaired in some way.

#vvsg

standard

A document that provides requirements, specifications, guidelines, or characteristics that can be used consistently to ensure that materials, products, processes, and services are fit for their purpose.

#vvsg

straight party override

Explicit voter selection that overrides or supplements the vote selections made by a straight party voting option. Straight party overrides may be subject to state election rules for how they work or whether they are allowed.

#vvsg

straight party voting

Mechanism that allows voters to cast a single vote to select all candidates on the ballot from a single political party.

#vvsg

street segment data

The portion of a street between two consecutive cross streets that can be assigned to a precinct.

#vvsg

support software

Software that aids in developing, maintaining, or using other software, for example, compilers, loaders and other utilities.

#vvsg

symmetric cryptography

Encryption system that uses the same key for encryption and decryption. This key must be kept secret.

#vvsg

system extent

Administrative unit that is the entire scope within which the voting system is used (for example, a county). The system extent corresponds to the top-level reporting context for which the system generates reports.

#vvsg

t-coil

Inductive coil used in some hearing aids to allow reception of an audio band magnetic field signal instead of an acoustic signal. The magnetic or inductive mode of reception is commonly used in conjunction with telephones, auditorium loop systems, and other systems that provide the required magnetic field output.

#vvsg

tabulate

Process of totaling votes.

#vvsg

tabulation report

A report containing the counts associated with ballots tabulated for a given voting unit.

#vvsg

tactile controls

Tactile controls are discernable or perceptible by touch using hands, feet, or other parts of the body. (Does not include touch screens.) Dual switches are a form of tactile controls that can be used by voters with minimal use of their hands.

#vvsg

technical data package

Manufacturer documentation relating to the voting system, which can include manuals, description of components, and details of architectural and engineering design.

#vvsg

test

Procedure used to determine one or more characteristics of a given product, process, or service according to a specified procedure for conformity assessment. A test may be an operational test or a non-operating test (for example, an inspection).

#vvsg

test deck

A set of marked ballots with a predetermined outcome. Used for logic and accuracy testing of a voting system.

#vvsg

test method

Specified technical procedure for performing a test, procedures by which tests are derived, or a combination of these.

#vvsg

test plan

Document created prior to testing that outlines the scope and nature of testing, items to be tested, test approach, resources needed to perform testing, test tasks, risks, and schedule.

#vvsg

test suite

Implementation of a set of operational tests for a particular object (such as a specific voting system) or class of objects (such as all voting systems that can interpret the language in which the test data are expressed).

#vvsg

third-party logic

Software, firmware, or hardwired logic that is neither application logic nor COTS. This includes, for example, general-purpose software developed by a third party that is either customized (for example, ported to a new platform, as is Windows Embedded Compact), not widely used, or source-code generated by a COTS package.

#vvsg

token

Something a user possesses and controls, typically a key or password, that is used to authenticate an identity.

#vvsg

touch screen voting machine

A voting machine that utilizes a computer screen to display the ballot and allows the voter to indicate their selections by touching designated locations on the screen.

#vvsg

town

An urban area that has a name, defined boundaries, and local government, and that is generally larger than a village and smaller than a city. Term used in New England, New York, and Wisconsin to refer to the equivalent of the civil township in these states.

#vvsg

township

A widely used unit of local government in the United States, subordinate to a county, with some form of local government for which it generally conducts elections.

#vvsg

undervote

Occurs when the number of voter selections in a contest is less than the maximum number allowed for that contest or when no selection is made. The number of undervotes is equal to the number of votes lost, for example, if no selection is made in a vote for two contest the number of votes lost is two.

#vvsg

Uniformed and Overseas Citizens Absentee Voting Act

Act of Congress in 1986 requiring that the states and territories allow certain groups of citizens to register and vote absentee in elections for Federal offices.

#vvsg

UOCAVA voter

An overseas voter or an active duty member of the U.S. military, either within or outside the United States, including any accompanying spouse and family members who are eligible to vote in their last place of residence in the United States. The Uniformed and Overseas Citizens Absentee Voting Act is commonly referred to as UOCAVA.

#vvsg

usability

Effectiveness, efficiency, and satisfaction with which a specified set of users can achieve a specified set of tasks in a particular environment. Usability in the context of voting refers to voters being able to cast valid votes as they intended quickly, without errors, and with confidence that their contest selections were recorded correctly. It also refers to the usability of the setup and operation of voting equipment in the polling place.

#vvsg

usability testing

Testing that encompasses a range of methods that examine how users in the target audience actually interact with a system, in contrast to analytic techniques such as usability inspection.

#vvsg

user-serviceable failure

Functional failure that can be remedied by a troubleshooter or election official using only knowledge found in voting equipment user documentation.

#vvsg

valid vote

See contest option vote.

#vvsg

validation

Process of evaluating a system or component during or at the end of the development process to determine whether it satisfies specified requirements.

#vvsg

visual format

A display format in which contest options and other information are displayed on screen or paper for perception using sight.

#vvsg

vote

Indication of support for a particular contest option.

#vvsg

vote center

A physical location where voters from multiple precincts may cast their ballots.

#vvsg

vote for N of M

A multi-seat contest in which voters are allowed to vote for a specified number ("N") of candidates.

#vvsg

vote variation

Voting style or feature, including but not limited to the following: approval voting, borda count, cumulative voting, n-of-m voting, plurality voting, proportional voting, range voting, ranked choice voting and super majority voting.

#vvsg

vote-by-mail

Method of voting by which eligible voters are mailed ballots and information packets by the local jurisdiction. Voters may be able to return their marked ballots by mail, bring them to an electionoffice, or drop them off in secure drop boxes.

#vvsg

vote-capture device

An electronic voting device that is used directly by a voter to make selections on a ballot.

#vvsg

voter

Person permitted to cast a ballot.

#vvsg

voter facing scanner

An electronic voting device that:

- accepts hand-marked or BMD-produced paper ballots one sheet at a time;
- is usually used for in-person voting;
- permits election workers to open and close the polls; scans a ballot and rejects it if either unreadable or un-processable; detects, interprets and validates contest selections; notifies

the voter of voting exceptions (such as undervotes or overvotes) or unreadable marks; stores accepted ballots in a secure container; sorts or otherwise marks ballots or ballot images that need subsequent human review; and tabulates and reports contest results after polls are closed. This unit was previously referred to as precinct count optical scanner or PCOS.

#vvsg

voter intent

A cognitive construct, formed by the voter, that they attempt to express through actions taken to mark, verify, and cast the issued ballot.

#vvsg

voter intent standard

A standard for counting ballots that aims to ensure that ballots are counted in accordance with the goals of the voter, using written rules for both human processes and machine algorithms to ensure that all ballots marked in a similar way are counted in the same way.

#vvsg

voter verifiable

A voting system feature that provides the voter an opportunity to verify that their contest selectionsare being recorded correctly before the ballot is cast.

#vvsg

voter verification

Confirmation by the voter that all votes were recorded as the voter intended.

#vvsg

voter verified paper audit trail

A paper document that the voter can review before officially casting their ballot.

#vvsg

voting device

Device that is part of the voting system.

#vvsg

voting process

Entire array of procedures, people, resources, equipment, and locations associated with conducting elections.

#vvsg

voting session

A collection of activities including ballot issuance, voter interaction with the vote-capture device, voting, verification, and casting.

#vvsg

voting station

The location within a polling place where voters may record their votes. A voting station includes the area, location, booth, or enclosure where voting takes place.

#vvsg

voting system

Equipment (including hardware, firmware, and software), materials, and documentation used to define elections and ballot styles, configure voting equipment, identify and validate voting equipment configurations, perform logic and accuracy tests, activate ballots, capture votes, count votes, reconcile ballots needing special treatment, generate reports, transmit election data, archive electiondata, and audit elections.

#vvsg

voting system software

The executable code and associated configuration files needed for the proper operation of the voting system.

#vvsg

Voting System Test Lab

Privately owned testing laboratories that test voting systems (and other election systems) for conformance to the Voluntary Voting System Guidelines (VVSG) or to other requirements, including individual state requirements. VSTLs are periodically reviewed for conformance to National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute for Standards and Technology (NIST).

#vvsg

white box testing

Testing based on an analysis of the internal structure of the component or system.

#vvsg

Wi-Fi

A wireless networking technology that uses radio waves to provide high-speed Internet network connections.

#vvsg

Wide Area Network

A network that connects computers across metropolitan, regional, and national boundaries. The internet is an example of a WAN.

#vvsg

wireless

Network connectivity using radio waves instead of wire connections.

#vvsg

write-in option

A type of contest option that allows a voter to specify a candidate, usually not already listed as a contest option. Depending on jurisdiction rules, in some cases only previously approved names will be considered as valid write-in contest selections.

#vvsg

zero report

A tabulation report produced at the opening of polls to check that there are no stored votes.

#vvsg

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Exhibit M

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF STATE

REPORT CONCERNING THE EXAMINATION RESULTS OF CLEARBALLOT CLEARVOTE 1.5 WITH CLEARCAST PRECINCT SCANNER, CLEARCOUNT CENTRAL SCANNING SOLUTION, CLEARACCESS BALLOT MARKING DEVICE, AND CLEARDESIGN ELECTION MANAGEMENT SYSTEM

Issued By:

Kathy Boockvar

Kathy Boockvar
Acting Secretary of the Commonwealth
March 22, 2019

EXAMINATION RESULTS OF CLEAR BALLOT CLEARVOTE 1.5 WITH CLEARCAST PRECINCT SCANNER, CLEARCOUNT CENTRAL SCANNING SOLUTION, CLEARACCESS BALLOT MARKING DEVICE, AND CLEARDESIGN EMS

I.   INTRODUCTION

Article XI-A of the Pennsylvania Election Code, 25 P.S. §§ 3031.1 *et seq.,* authorizes the use of electronic voting systems. Section 1105-A of the Pennsylvania Election Code, 25 P.S. § 3031.5, requires that the Secretary of the Commonwealth (Secretary) examine all electronic voting systems used in any election in Pennsylvania and that the Secretary make and file a report stating whether, in her opinion, the electronic voting system can be safely used by voters and meets all applicable requirements of the Election Code. Upon the request of Clear Ballot Group (Clear Ballot), the Department of State's Bureau of Commissions, Elections and Legislation (Department) scheduled an examination for October 29, 2018 of ClearVote 1.4.5 voting system.

The Secretary of the Commonwealth (Secretary) appointed SLI Global Solutions and Center for Civic Design (CCD) as professional consultants to conduct an examination of ClearVote 1.4.5 voting system. The examination process included a public demonstration and functional examination (functional examination) and accessibility examination. The functional and accessibility examinations were performed in Room G24A/B of the Commonwealth Capitol Complex - Finance Building, 613 North Street, Harrisburg, PA 17120. Mike Santos, Senior Test Manager, and Kyle Johnson, Senior Test Engineer, (Functional Examiner) of SLI Global Solutions, conducted the functional examination of the ClearVote 1.4.5 pursuant to Section 1105-A(a) of the Election Code, 25 P.S. § 303l.5(a). Whitney Quesenbery, Denis Anson, Michael Weisman and Suzanne Chapman (Accessibility Examiner) representing CCD performed an accessibility examination of the ClearVote 1.4.5 system. The examinations commenced on October 29, 2018 and lasted approximately four days. Jonathan Marks, then Commissioner of the Bureau of Commissions, Elections and Legislation; Kathryn Boockvar, then Senior Advisor to the Governor on Election Modernization; Jessica Myers, then Deputy Director, Office of Policy;

Kathleen Kotula, Executive Deputy Chief Counsel, Office of Chief Counsel; and Sindhu Ramachandran, Voting Systems Analyst, represented the Secretary of the Commonwealth. Afua Twamasi-Ankrah, Manager Certification, and Dylan Sleeth, Feild Support Engineer, represented ClearBallot. Additional staff members from the Department also attended the examination. The functional examination was open to the public and was videotaped by Department staff. The functional examination identified that votes on hand-marked paper ballots were not tabulated correctly for cross party nominated candidates when using the straight party option. Clear Ballot withdrew ClearVote 1.4.5 from PA state and EAC certification process to focus efforts on their enhanced ClearVote 1.5 system.

Thereafter, ClearBallot submitted their new release, ClearVote 1.5, which included the tabulation fixes for cross party nominated candidates to the Department for state certification. The voting system presented for certification in Pennsylvania included the following components

- ClearDesign1.5.1- Election management system responsible for ballot layout, proofing, and voting machine file generation
- ClearAccess 1.5.1- electronically-assisted ballot marking device with accessible features
- ClearCast 1.5.1 - precinct scanning, tabulation, and reporting system,
- ClearCount 1.7.1 – Central scanning solution capable of high-speed ballot scanning and results aggregation from ClearCast units, and reporting, export, and audit.

The Functional Examiner performed functional examination of ClearVote 1.5 at SLI Global Solutions located in Wheat Ridge, Colorado between January 8 and February 26, 2019, details of which are explained in further sections of this report. Department staff observed the examination via web conference. The testing was conducted in different sessions. Jordan Esten, Chief Executive Officer, Keir Holeman, Director of Sales Engineering, and Ben Iredale, Product Manager, represented ClearBallot. The examination was videotaped by SLI and the video is on file at the Department.

The Department held a demonstration of the ClearVote 1.5 on January 18, 2019. The demonstration and examination was performed in Room G24A/B of the Commonwealth Capitol Complex - Finance Building. Kyle Johnson, Senior Test Engineer of SLI Global Solutions, conducted the examination. Jonathan Marks, then Commissioner of the Bureau of Commissions, Elections and Legislation; Jessica Myers, then Deputy Director, Office of Policy; Kathleen Kotula, Executive Deputy Chief Counsel, Office of Chief Counsel; Michael Moser then Deputy Commissioner of the Bureau of Commissions, Elections and Legislation and Sindhu Ramachandran, Voting Systems Analyst, represented the Secretary of the Commonwealth. Afua Twamasi-Ankrah, Manager Certification, and Ben Iredale, Product Manager, represented ClearBallot.

Clear Ballot submitted a report of the security assessment and penetration testing of the Clear Ballot Group (CBG) ClearVote 1.5 Voting System to the requirements set forth in the Commonwealth of Pennsylvania Voting System Security Standards. The Department further worked with SLI Compliance, the appointed Security Examiner, to review the test report and confirm that there were no gaps in testing. Jesse Peterson and Mike Santos, representing SLI, reviewed the report and confirmed that the testing was done per Pennsylvania voting system security standard and did not suggest any additional testing.

The Department in consultation with the accessibility examiner determined that the results of the accessibility examination conducted as part of the ClearVote 1.4.5 examination may be utilized for ClearVote 1.5 certification since the changes between versions did not have an effect on the accessibility and usability of the system. However, the Accessibility Examiner recommended an examiner review of the sip and puff device implementation, since the use of sip and puff was not successfully tested during the initial examination. Validation of the sip and puff device was done on February 5, 2019, and the Accessibility Examiner report was updated to reflect the testing.

II.   THE CLEARVOTE 1.5 VOTING SYSTEM

ClearVote 1.5 is a paper-based voting system that provides end-to-end election

support; from defining an election to generating final reports. The system presented for certification in Pennsylvania is comprised the following components -

- ClearDesign election management system
- ClearAccess in-person accessible voting solution
- ClearCast in-person precinct-scan voting solution
- ClearCount central scanning, tabulation, results consolidation and reporting solution

The following is a description of the ClearVote 1.5 components summarized from System Overview section of the Functional Examiners report and ClearVote System Overview document submitted by Clear Ballot as part of the Technical Data Package (TDP).

ClearDesign

ClearDesign is an election management system consisting of an interactive set of applications which are responsible for all pre-voting activities necessary for defining and managing elections. This includes ballot design, ballot proofing, ballot layout, and ballot production. All of the hardware components are unmodified COTS that are connected via a wired, closed, and isolated network not connected to any other systems or the Internet. The election management system (EMS) is used for the following tasks:

- Create and import jurisdiction data
- Lay out, proof, and produce both paper and accessible ballots in supported languages
- Program the other ClearVote products

Election department staff can design ballots, proof their design (including accessible ballots), lay out and review one or all ballot styles (including HTML-based accessible ballots), generate PDFs for ballot-printing companies and ballot-on-demand printers, and generate the election definition files that program the other components.

ClearAccess

The ClearAccess system is an in-person ballot-marking system designed to ensure access for all voters. The ClearAccess solution runs on a COTS touchscreen computer. The voter can privately and independently indicate his or her choices on the touchscreen, review the selections, make corrections as necessary, print a machine-marked ballot. The ballots can then be scanned and tabulated by ClearCast or ClearCount. The ClearAccess software logs all transactions without compromising voter privacy, and stores no results data because its output is a marked paper ballot.

ClearCast

The ClearCast tabulator is a precinct count ballot scanning solution and processes hand-marked paper ballots and ballots printed by ClearAccess accessible ballot marking device. The ClearCast application runs on the precinct count-based tabulator, and is used to scan, count and tally marked ballots. Its functionality is divided into three essential modes: 1) Election Mode (Early Voting and/or Election Day), which is used to process voter cast ballots; 2) Pre-Election Mode, which occurs prior to Election Mode, and is used to test all system functionality subsequent to the start of the election; and 3) Post-Election Mode, which is used to perform administrative functions following the close of the election.

ClearCount

ClearCount is a central, high-speed, optical scan ballot tabulator coupled with ballot processing applications. The ClearCount tabulation system processes ballots and captures voter intent. It handles four important functions:

1. Central count tabulation

2. Consolidating results imported from precinct voting stations

3. Generating operational reports and contest reports

4. Logging the activities and data required for independent audits

The ClearCount tabulation system consists of the following physical components (all

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of which are unmodified COTS hardware and are connected via closed, wired Ethernet connections):

- ScanServer—A computer running the ClearCount software and hosting its election database and the web server that serves its election reports. The ScanServer uses a Linux operating system (a configured version of which is installed with the ClearCount software).

- ScanStations—One or more computer-scanner pairs used to scan and tabulate ballots. The ScanStation computers use the Microsoft Windows operating system.

- Router—Connects the ScanStations and the election administration stations to the ScanServer via a closed, wired Ethernet. (Optionally, a switch can be added for larger elections that require more ScanStations.)

- Election administration stations—One or more Microsoft Windows computers installed with browser software. Election officials use this computer to manage elections and users, to monitor and interact with election reports, and to adjudicate unreadable cards. System administrators use it to monitor the ClearCount system.

Manufacturer Software/Firmware

The **ClearVote 1.5** voting system consists of the following software and firmware components:

Application	Version
ClearDesign	1.5.1
ClearCast	1.5.1
ClearAccess	1.5.1
ClearCount	1.7.1

COTS Software/Firmware

Additional COTS software and firmware included in the system has been defined as part of the EAC system certification scope added to this report as Attachment A.

Hardware

Below is a listing of the hardware components that comprise the entire Clear Vote 1.5 system categorized by system functionality:

Component	Model
ClearDesign Components	
Dell Latitude Laptop	5580
Dell PowerEdge Server	T630
Component	Model
Dell 24 inch Monitor	SE2416H
Dell 22 inch Monitor	E2216HV
Dell Mini Tower	T3620
TP-LINK VPN Router	TL-R600VPN
Lenovo USB Portable DVD Burner	LN-8A6NH11B
Brother Printer	HL-L2340DW
ClearAccess Components	
Dell OptiPlex AIO	5250
Dell 15" Inspiron	7000 series
Brother Laser Printer	HL-L2340DW
Oki Data Laser Printer	B432dn
Storm EZ Access Keypad	EZ08-222013
Origin Instruments Sip/Puff Breeze with Headset	AC-0313-H2

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Hamilton Buhl Over-Ear Stereo Headphones	HA7
ElectionSource Table Top Voting Booth (Privacy Screen)	VB-60B
APC Smart-UPS	SMT2200
Ergotron Stand for Dell OptiPlex 5250 AIO (portrait mode)	Neo Flex
Wurth Ferrite (for Oki printer)	742-416-33S
Wurth Ferrite (for Brother printer)	742-416-22S
3M EMI Copper Foil Shielding Tape¼ inch	1181
Lexan or acrylic plastic cover (8 mm)	2"x4"
ClearDesign Components	
Component	**Model**
Dell Latitude Laptop (multiple units)	5580
Dell PowerEdge Server	T330
Dell OptiPlex AIO	7440
Dell Precision Workstation	T3620
Fujitsu Scanner	fi-7180
Fujitsu Scanner	fi-6800
Fujitsu Scanner	fi-6400
Lenovo USB Portable DVD Burner	LN-8A6NH11B
Dell 22 inch Monitor	E2216HV
Dell 22 inch Monitor	P2217
Dell 22 inch Monitor	S2240M
Dell 27 inch Monitor	P2717H
Cisco Catalyst Switch (1 Gigabit Router or Switch)	2960-X Series
TP-LINK Easy Smart Switch (1 Gigabit Router or Switch)	TL-SG108E

NetGear ProSafe VPN Firewall (1 Gigabit Router or Switch)	FVS318G
APC Smart-UPS	SMT1500
Western Digital External Hard Drive	WDBBGB0040HBK
EZ Scanning Shelf (fi-6400 or fi-6800)	Model: WorkEZ
ClearCast Components	
ClearCast	Model: 1 Version A
Ballot Box	1224UBB-CB

Please refer to Attachment A of this report for the EAC certification scope document, which lists all software and hardware components of the EAC certified system.

Test Materials

Test support materials utilized during the examination included:

- Thermal receipt paper for the ClearAccess BMD and ClearCast precinct scanner
- Ballot card stock for processing ballots on the ClearAccess
- Ballot stock, for printing of ballots to be processed by the ClearCast and ClearCount
- USB thumb drives
- Ballot-marking pens

III.   EXAMINATION APPROACH, PROCEDURES AND RESULTS

A.   Examination Approach

Functional Examination

To ascertain whether ClearVote 1.5 can be safely used by voters at elections in the Commonwealth and meets all the requirements of the Pennsylvania Election Code, the Examiners developed test protocols for the examination. The test protocols separated the

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requirements of Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 - 3031.22, into seven main areas of test execution: (1) Source Code Review; (2) Documentation Review; (3) System Level Testing; (4) Security/Penetration Testing; (5) Privacy Analysis; (6) Usability Analysis and (7) System Accuracy Validation. The Functional Examiner performed Security/Penetration Testing, Privacy Analysis and Usability Analysis on ClearVote 1.4.5 and then did a follow-up testing on ClearVote 1.5.

Source Code Review was performed prior to the functional examination to determine if there are any vulnerabilities found that would warrant additional security examination.

Documentation Review was performed to verify that the portions of the Pennsylvania Election Code, which reference documentation detail, are sufficiently met by the Clear Ballot ClearVote 1.5 documentation. The Functional Examiner validated compliance of the system with the following sections of the Election Code during the documentation review.

- 1105-A(a), 25 P.S. § 3031.5(a), requiring that an electronic voting system has been examined and approved by a federally recognized ITA;

- 1107-A(11), 25 P.S. § 3031.7(11), requiring an electronic voting system to be suitably designed in terms of usability and durability, and capable of absolute accuracy;

- 1107-A(13), 25 P.S. § 3031.7(13), requiring an electronic voting system to correctly tabulate every vote;

- 1107-A(14), 25 P.S. § 3031.7(14), requiring an electronic voting system to be safely transportable; and

- 1107-A(15), 25 P.S. § 3031.7(15), requiring an electronic voting system to be designed so voters may readily understand how it is operated.

System Level Analysis examined the Clear Vote 1.5 voting system in terms of conducting an election. The Functional Examiner created election definitions using Clear Design and populated the voting devices (Clear Access, ClearCast and ClearCount) with election definitions using transport media. Votes were captured using ClearAccess and ballots were printed and tabulated via ClearCast precinct scanner. Ballots were also marked manually and then tabulated through the polling place ClearCast scanner. All ballots (hand-

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marked paper ballots and Clear Access ballots) created were then tabulated through the ClearCount central scanner. Tabulation results were then processed using the ClearCount consolidation and reporting solution, write-in votes were counted, and reports were generated with results for the election. The results reports were then validated against the expected results of the voted ballots.

All components of the ClearVote 1.5 system were exercised to verify that they meet all pertinent requirements of the Pennsylvania Election Code. The test cases were designed to ascertain compliance with the following sections of the Election Code:

- 1101-A, 25 P.S. § 3031.1, requiring an electronic voting system to provide for a permanent physical record of all votes cast;

- 1107-A(2), 25 P.S. § 3031.7(2), requiring an electronic voting system to permit voting on both candidates and ballot questions, according to the official ballot;

- 1107-A(3), 25 P.S. § 3031.7(3), requiring an electronic voting system to permit straight party voting, including the "Pennsylvania method" of straight party voting;

- 1107-A(4), 25 P.S. § 3031.7(4), requiring an electronic voting system to permit a voter to vote for candidates of all different parties, and write-in candidates;

- 1107-A(5), 25 P.S. § 3031.7(5), requiring an electronic voting system to permit a voter to enter write-in votes;

- 1107-A(6), 25 P.S. § 3031.7(6), requiring an electronic voting system to permit a voter to cast votes for candidates and ballot questions he or she is entitled to vote for, and prevents a voter from casting votes the voter is not entitled to vote on;

- 1107-A(7), 25 P.S. § 3031.7(7), requiring an electronic voting system to prevent over-votes;

- 1107-A(8), 25 P.S. § 3031.7(8), requiring an electronic voting system to prevent a person from casting more than one vote for a candidate or question, except where this type of cumulative voting is permitted by law;

- 1107-A(9), 25 P.S. § 3031.7(9), requiring an electronic voting system to permit voters to vote in their own parties' primaries, and prevents them from voting in other parties' primaries, while also permitting voters to vote for any nonpartisan nomination or ballot question they are qualified to vote on; and

- 1107-A(10), 25 P.S. § 3031.7(10), requiring an electronic voting system that registers votes electronically to permit voters to change their votes up until taking

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the final step to register the vote, and for systems that use paper ballots or ballot cards, permits a voter to get a new ballot in the case of a spoiled ballot, and to mark and cancel the spoiled ballot;

- Parts of 1107-A(16), 25 P.S. § 3031.7(16), requiring an electronic voting system which provides for district-level tabulation to include (i) a public counter to register how many ballots are submitted to be counted; (iv) will not tabulate an over-vote, with an option to notify a voter of an over-vote if used during voting hours; and (v) generates a printed record that counters are set to zero before voting commences; and

- Parts of 1107-A(17), 25 P.S. § 3031.7(17), requiring an electronic voting system which provides for central-count tabulation to (ii) preclude tabulation of an over-vote; and (iii) indicate that counters are set to zero before processing ballots, either by district or with the capability to generate cumulative reports.

The Functional Examiner also used the System Level Testing to further evaluate the design and accuracy aspects of the system as required by Sections 1107-A(11) and (13), 25 P.S. §§ 3031.7(11) & (13), through his use at public demonstration, even though the requirements were already validated in the documentation review phase by reviewing EAC certification reports.

The Security/Penetration Analysis examined the voting system's compliance with the requirements of the Pennsylvania Election Code by analyzing physical security procedures and impoundment of ballots. Precinct tabulation devices were installed for delivery to the precinct, and the Functional Examiner analyzed the pertinent security procedures performed on each device to ascertain compliance with Section 1107-A(12), 25 P.S. § 3031.7(12), requiring an electronic voting system to provide acceptable ballot security procedures and impoundment of ballots to prevent tampering with or substitution of any ballots or ballot cards. The Functional Examiner also used the security analysis phase of testing to validate compliance with parts of Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17) that relate to system security. For the Security/Penetration Analysis, the Functional Examiner performed an initial Examination on ClearVote 1.4.5, with a follow up Examination on ClearVote 1.5.

The Privacy Analysis examined the voting system's compliance with Section 1107-A(l) of the Election Code, 25 P.S. § 3031.7(1), requiring that an electronic voting system

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provide for absolute secrecy of the vote, by analyzing how the polling place devices (ClearAccess and ClearCast) met the pertinent privacy requirements. For the privacy analysis, the Functional Examiner performed an initial Examination on ClearVote 1.4.5, with a follow up Examination on ClearVote 1.5.

The Usability analysis evaluated the compliance of the voting system to Sections 1107-A(14) and (15), 25 P.S. §§ 3031.7(14) & (15). The results from the tests were used by the Functional Examiner to supplement his conclusions from the documentation review phase. For the Usability analysis, the Functional Examiner performed an initial Examination on ClearVote 1.4.5, with a follow up Examination on ClearVote 1.5.

The System Accuracy validation was included in the test protocol to ensure that the system will be able to maintain performance and accurately tabulate a volume of ballots that gets scanned in a typical PA polling place, without errors. This testing was done to ensure compliance with 1107-A(11)) and (13), 25 P.S. §§ 3031.7(11) & (13), requiring an electronic voting system to capable of absolute accuracy and be able to correctly tabulate every vote.

The functional test execution was completed in multiple test sessions. The below table depicts the testing date/s and test events.

Test Start Date	Location	Summary
1/11/2019	SLI Labs, Wheatridge, CO	System Level testing with 90lb index ballot stock had to be halted, during general election run due to overvote warnings and tabulation errors and poor quality ballots.
1/18/2019	Capitol Complex, Harrisburg PA	System Demonstration and a PA general election with around 30 ballots were run using 90 lb index ballot stock and actual results matched expected results.
1/29/2019	SLI Labs, Wheatridge, CO	System Level testing had to be halted since the 90 lb index ballot stock provided by ClearBallot was slightly wider than the scanner scanning limit.
2/7/2019	SLI Labs, Wheatridge, CO	System Level testing – general election and closed primary election with 90lb index stock completed and

		actual results matched expected results.
2/25/2019	SLI Labs, Wheatridge, CO	System Accuracy Testing – A general election with 1000 ballots of 60lb and 65lb index stock were run and the results reconciled.

Accessibility Examination

The accessibility examination was designed to provide insight and information on each voting system's usability and accessibility, especially for voters with disabilities and for poll workers responsible for managing the system on Election Day. The Accessibility Examination was conducted during the week of October 29,2018 and used the ClearVote 1.4.5 system. Examination included a team of examiners with accessibility, usability and election process experience (collectively referred as "Accessibility Examiner"). The examination process was divided into three parts:

1. **Expert review** by the Accessibility Examiner, using scenarios based on personas of people with disabilities from National Institute of Standards and Technology (NIST) and their professional experience.

2. **Voters with disabilities used** the system voting a reasonable length PA ballot and completed a questionnaire about their experience. The Accessibility Examiner observed and made notes.

3. **Election officials and poll workers tested the accessibility features** to evaluate how they would be activated during an election. They commented on the system based on their experience.

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The testing team constructed a typical PA ballot, with a mix of contest types and variation in the number of candidates to be voted for each contest. The Accessibility Examiner conducted an expert review, observed 7 voters with disabilities, and worked with 9 poll workers in a guided review of the systems.

After the initial examination, the Accessibility Examiner further did an examiner review of the ClearVote 1.5 system on February 5, 2019 to validate the sip-and-puff accessible device. The results of this review were incorporated into the report submitted to the Secretary.

Security Testing

The Security testing provided a means to assess the required security properties of the voting system under examination and ascertain compliance with the Pennsylvania Election Code requirements, including 25 P.S. §§ 3031.7(11), (12), (16), & (17). The security tests specifically addressed confidentiality, vote anonymity, integrity, availability, and auditability of the voting systems. Clear Ballot submitted a test report of security assessment and penetration testing of the ClearVote 1.5 voting system to the requirements set forth in Pennsylvania Voting System Security Standards The testing was done by Pro V&V Labs, the Voting System Test Lab (VSTL) that tested ClearVote 1.5 voting system for federal certification. The report identified test procedures and results of the testing. Testing was divided into two distinct but united efforts: Security Specification Conformity and Penetration Testing. The Department further reviewed the submitted test report with SLI compliance to ensure that there is no additional testing required.

B.   Examination Process and Procedures

The examination process and procedures followed for ClearVote 1.5 examinations are listed in the below sections. The final determination in this report is based on the combined analysis of the results and conclusions from all the tests.

ClearVote 1.5 Examination

Functional Examination

Clear Ballot supplied all the hardware equipment required for the examination. All software and firmware necessary to perform the examination was received directly from the Voting System Test Laboratories (VSTL) that tested the voting system for EAC certification. The trusted build of the software and firmware for each device being evaluated were installed using the appropriate media for installation. The hash codes for all system components were captured using the process listed in the manufacturer's Technical Data Package (TDP) by the Functional Examiner with assistance from a Clear Ballot representative. The Functional Examiner further compared and confirmed that all the captured hash codes matched the hash codes for the EAC certified system executables before executing the test scripts.

Testing at SLI Labs on January 11,2019

The Functional Examiner created the election definition using ClearDesign and prepared the precinct tabulation device ClearCast, polling place Ballot Marking Device ClearAccess and ClearCount central scanning solution with Fujitsu central scanners fi-6400 and fi-6800 using transport media. The polling place was set up and a general election was then run using ballots printed on 90lb index paper stock. Polls were closed and reports were printed from the ClearCast precinct scanner and ClearCount tabulation system to reconcile results against expected results.

The test did not complete successfully due to tabulation errors and overvote warnings. ClearCast and ClearCount tabulated the same ballots differently and system was counting blank ovals as votes. The ballots were printed on 90lb index ballot stock, using the OKI Data Laser printer B432dn (OKI 432) and the functional examiner noted that the ballots were smudged, and the ink was flaking from the paper. ClearBallot provided a root cause analysis (RCA) to the reported issue, suggesting that the printer settings used for the ballot stock needs to be "heavy" as opposed to "medium/heavy" suggested in ClearBallot TDP. The RCA also suggested that the ClearCast scanner needs to be calibrated before use with a blank ballot stock before operation.

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System Demonstration at Harrisburg on January 18, 2019

The Department requested a demonstration and functional test of ClearVote 1.5. Department personnel, Functional Examiner and Clear Ballot representatives were present for the demonstration. The system demonstration was held on January 18, 2018, at Room G24A/B of the Commonwealth Capitol Complex - Finance Building. The demonstration and test execution took approximately one day. The Functional Examiner performed system level testing by running a PA General Election using the 90lb index paper stock. The Functional Examiner created the election definition using ClearDesign and prepared the precinct tabulation device ClearCast and polling place Ballot Marking Device ClearAccess using transport media. Blank ballots and marked ClearAccess ballots were printed using the OKI432 printer. The printer setting used was "heavy". The polling place was set up and ballots were marked by hand and using ClearAccess. All ballots were scanned using the ClearCast precinct scanner and results were reconciled against expected results.

Testing at SLI labs on January 29,2019

This test was planned to execute test cases from System Level Testing, since the earlier attempt to test on January 14 did not tabulate results appropriately. The Functional Examiner created the election definition using ClearDesign and prepared the precinct tabulation device ClearCast and polling place Ballot Marking Device Clear Access using transport media. The polling place was set up to run a general election. The Examiner marked ballots by hand and Clear Access using the 90 lb index stock. The printer setting on the OKI432 printer was set to "heavy" as opposed to "medium" as suggested by ClearBallot. The test had to be halted since the ballots were not of the appropriate size to be scanned thru the Clear Cast scanner.

Testing at SLI Labs on February 6 and 7, 2019

This test was planned to execute test cases from System Level Testing, since the earlier attempts to complete System Level Testing on January 11 and January 29 did not complete successfully. The Functional Examiner created the election definition using

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ClearDesign and prepared the precinct tabulation device ClearCast and polling place Ballot Marking Device Clear Access using transport media. The polling place was set up, and a closed primary and general election were run. The Examiner marked ballots by hand and Clear Access using the 90 lb index stock. The printer setting on the OKI 432 printer was set to "heavy". The ballots were scanned thru the Clear Cast precinct scanner and ClearCount central scanning solution with COTS scanners Fujitsu fi-6800 and fi-6400. Polls were closed, and results were tabulated and validated against expected results.

Testing at SLI Labs on February 25 and 26, 2019

This test was planned to execute a test simulating a standard PA polling place in the volume of ballots scanned. The Department of State in consultation with EAC and the Functional Examiner decided to perform this test to ensure that the system accuracy and performance can be ascertained. Clear Ballot provided the 60lb and 65lb ballot stock used for this test. The Functional Examiner prepared a general election ballot using Clear Design. ClearAccess, ClearCast and Clear Count were prepared for use in an Election setting. A total of 1000 ballots were run with each ballot stock being tested, of which 250 were marked and printed using Clear Access, 250 were printed using the OKI432 printer and marked by hand, 500 were commercially printed and marked by hand. Polls were closed after each set of ballots were scanned, and results were tabulated and validated against expected results.

Accessibility Examination

The accessibility examination portion was done on the Clear Vote 1.4.5 system and commenced on October 29, 2018, at Room G24A/B of the Commonwealth Capitol Complex - Finance Building, 613 North Street, Harrisburg, PA 17120.

The examination lasted approximately three days followed by a debrief meeting on October 31,2018 with DOS and CCD to discuss initial findings.

This test examined the ClearAccess touch screen ballot marking device and the ClearCast optical scanner. Included in this system is an off-the-shelf, OKI laser printer.

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The typical voting experience involves the voter making selections on ClearAccess to mark their ballot, printing their ballot using an OKI432 printer, and then scanning their printed ballot on the ClearCast to cast the ballot.

ClearAccess accessibility features

- 21" Touch screen, in portrait orientation

- Audio assistance with one voice

- Tactile key pad with different-shaped and different-colored buttons. Each button had a raised identifier on it, but only the help button used Braille.

- Sip-and-puff device, with USB connector

- Audio output jack

- Voter settings:

- Language choice

- Audio volume and voice speed changes

- Text Size (Small, Normal, Large, and Extra Large)

- Screen contrast options: color, white background with black text, black background with white text, black background with yellow text, and low contrast/grey scale

- Screen blank, while using the audio only

ClearCast scanner

- The scanner had no notable accessibility features.

The machine features listed above are not exhaustive. For more information about

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the ClearAccess and ClearCast systems, refer to the vendor provided technical specifications.

The examination included expert review by the Accessibility Examiner, sessions with 9 poll workers representing Dauphin, Lancaster and Perry counties, and sessions with 7 voters with disabilities using different assistive devices for voting. The voter sessions each took approximately an hour and the poll worker sessions took approximately 90 minutes each. Clear Ballot supplied the hardware and supplies for the Accessibility Examination. The equipment was prepared for the examination by loading the required election definition using transport media. The Accessibility Examiner prepared voting scenarios for each voting session to allow comparison of results between each session. The scenarios were constructed to provide a structured opportunity to explore how the system works in all interaction modes, using:

- Visual display mode with default settings and use of enhanced options for text size, brightness, and contrast
- Audio format with options for volume and tempo
- Touch input and navigation on the display screen
- Input and navigation using a tactile keypad
- Input and navigation using a sip-and-puff

Both the ballot contents and the instructions for marking the ballot were designed to exercise different types of interactions (navigation in ballot, navigation in contest, undervotes, overvotes, straight party). The ballot included both very short contests, and those long enough to potentially fill more than one screen, even at the default text size.

Expert Review by Accessibility Examiner

The Accessibility Examiner used the same ballot and instructions to be used for voter and poll worker review, for their expert review, so they would be familiar with the interaction voters would experience.

Sessions with voters

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Each voter session took about an hour. They included:

- An opening interview about their previous voting experience and the types of assistive technology they used in both daily life and in voting.

- Orientation to the system with an opportunity for voters to ask questions about any assistive technology available.

- Voting a ballot, following instructions given verbally by the Accessibility Examiner. Voters were encouraged to give feedback as they went through the ballot. The Accessibility Examiner and the voters discussed any feedback and questions that occurred during the voting sessions and re-evaluated any findings as necessary.

- A closing interview including a questionnaire about their reactions to the experience of using the voting system.

All voters used ClearAccess to mark their ballot and printed their ballot using the OKI 432 printer. The ClearCast scanner was not set up for the accessibility election ballot and hence the Accessibility Examiner evaluated the ClearCast scanner using a different election definition.

Sessions with poll worker groups

The sessions took 60-90 minutes each, depending on how many people were in each group. The session included:

- A brief orientation to the voting system and the access features, similar to the way a poll worker trainer might introduce the system.

- The poll workers each then marked a ballot, tried out the access features if they wanted, and were given an opportunity to read the "During Election Day" instructions provided with the system

- The Accessibility Examiner presented them with scenarios of different access needs and asked them to help set up the system for one of the facilitators acting as the voter in each of the scenarios. Poll worker groups

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did not participate in scenarios for voters with physical dexterity disabilities because the only device for these voters, the sip-and-puff was not working properly, so this left only the audio and tactile keypad for demonstrations.

The Accessibility Examiner took notes about aspects of the system that worked well and problems they encountered during all three phases of the examination. The issues were then categorized based on their impact on a voter's ability to vote independently and privately.

- Positives – things that voters mentioned as meeting or exceeding their expectations

- Annoyances – things voters mentioned as problems, but which did not significantly slow their progress in marking their ballot

- Problem solving – instances where voters hesitated and had to figure out how to complete an action or task, but were able to do so on their own, by exploring the system or relying on past experience with technology

- Needs assistance - problems that could only be solved with help, such as instructions or assistance from a poll worker

- Likely to prevent independent voting for voters with some disabilities - problems that could prevent successful independent and private voting, even with good knowledge about how to use the system and accessibility features

The Accessibility Examiner did a retest of the sip-and-puff device on February 5, 2019 because the initial examination did not provide enough evidence that the device works accurately.

The Accessibility Examiner then compiled the findings including categorizations from the examination into a report submitted to the Secretary.

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Security Testing

ClearBallot submitted a security test report with the results obtained by conducting the security assessment and penetration testing of the ClearVote 1.5 system to the requirements set forth in the Pennsylvania Voting System Security Standard. The report included test results that were designed and executed adhering to the specifications in the PA Voting System Security Standard. The security testing was done as part of the voting system EAC certification test campaign at Pro V&V labs, the VSTL that tested to the system for federal certification.

The Department further reviewed the report with SLI Compliance, the contracted voting system examiner, to ensure that the test report shows enough evidence of the testing done to the PA voting system security standard and no additional testing is needed.

C.   **Examination Results**

Clear Vote 1.5 Functional Examination

The Functional Examiner's report indicated successful completion of tests executed to ascertain compliance with Pennsylvania election code requirements mandated by the Pennsylvania Election Code. The Examiner report for ClearVote 1.5 included details of the test cases, execution and successful completion.   The following section is a summary of the results of the examination as set forth in fuller detail in the Examiner's Report.

1.   Source Code Review

Source Code Review for ClearVote 1.5 was performed, with a focus on determining whether any vulnerabilities could be found. The Functional Examiner reported that the code review was completed with no identified malicious software, cryptographic software, process control or password management vulnerabilities. The Examiner concluded that no deficiencies were found during source code review.

2.   Documentation Review

The Documentation Review testing performed by the Functional Examiner demonstrates that the ClearVote 1.5 meets the relevant requirements of the Pennsylvania Election Code. The Examiner reviewed the "Draft Test Report for EAC 2005 VVSG Certification Testing of ClearVote 1.5 Voting System".

The review of the EAC test reports by the Functional Examiner and the EAC certifications submitted by ClearBallot satisfy the requirements of Section 1105-A(a) of the Election Code, 25 P.S.§ 3031.5(a): requiring that an electronic voting system has been examined and approved by a federally recognized independent testing authority (ITA), or VSTL as such authorities are now called, as meeting the applicable performance and test standards established by the federal government.

The Functional Examiner concluded that the design requirements of Sections 1107-A(11) and (14) of the Pennsylvania Election Code, 25 P.S. §§ 3031.7(11) & (14), are met by the combination of EAC hardware Non-Operating Environmental Tests, which included bench handling, vibration, low temperature, high temperature, humidity and product safety tests. The system accuracy testing during EAC certification testing provided confirmation of system accuracy as required by Section 1107-A(11) of the Pennsylvania Election Code, 25 P.S. § 3031.7(11). The Functional Examiner further validated this during the System Accuracy Validation test phase by running a general election test with 1000 ballots with 2 separate ballot stocks.

The system summative usability test reports were accepted by the EAC as part of the Federal Certification. This, along with the Functional Examiner's use of the system, demonstrates that the system can be readily learned and hence satisfied the usability requirement of Section 1107-A(15) of the Pennsylvania Election Code, 25 P.S. § 3031.7(15).

    3.   <u>System Level Testing</u>

As set forth in the examination approach, System Level Testing was divided into two separate tests, a closed primary election and a general election. The ballots defined had contests with voting variations supported in Pennsylvania. As discussed in Examination

Process and Procedures Section, there were multiple attempts to run this test and the results summarized below are from the successful test runs.

A closed primary election consisting of two parties (Republican, Democratic), and three precincts was run utilizing Clear Design, Clear Access, Clear Cast and Clear Count. The Republican ballot contained 21 contests: 19 partisan contests and 2 referendums, 10 "Vote for One", 1 "Vote for no more than Two", 3 "Vote for no more than Three", 4 "Vote for no more than Four" and 1 "Vote for no more than Fifteen". The Democratic ballot contained 21 contests: 19 partisan contests and 2 referendums, 11 "Vote for One", 1 "Vote for no more than Two", 1 "Vote for no more than Three", 5 "Vote for no more than Four" and 1 "Vote for no more than Fifteen". Referendum contests were added to test the generation of non-partisan ballots. The Functional Examiner validated compliance of the system to Sections 1101-A and 1107-A(2), (5)-(11), 25 P.S. §§ 3031.1, 3031.7(2), (5)-(11). No issues or anomalies were experienced during these tests, and the objective criteria established in the test protocols were met.

A general election consisting of four parties (Republican, Democratic, Green and Libertarian), three precincts (one of which was a split precinct), and 21 contests: 19 partisan contests and 2 retentions, 11 "Vote for One", 1 "Vote for no more than Two", 6 "Vote for no more than Three", and 1 "Vote for no more than Fifteen" was run utilizing Clear Design, Clear Access, Clear Cast and Clear Count . The Functional Examiner examined the compliance of the system to Sections 1101-A and 1107-A(2)-(8), (10)-(11) and (13), 25 P.S. §§ 3031.1, 3031.7(2)-(8), (10)-(11) & (13).

The Functional Examiner included test cases to validate Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17), which mandate that voting systems generate zero proof reports and correctly handle over-votes during the election runs. The remainder of the requirements of 25 P.S. §§ 3031.7(16) and (17) were validated by the Functional Examiner during the Security/Penetration Analysis.

Election definitions for both primary and general elections were created within Clear Design and transport media was used to transfer those definitions to ClearCast , ClearAccess

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and ClearCount. Polls were opened and ballots were marked manually, as well as electronically via the Clear Access Ballot Marking Device, then tabulated through the polling place ClearCast scanner. All ballots (hand-marked, and ClearAccess) created were then tabulated through the ClearCount central scanning solution using two COTS central scanners, Fujitsu Scanner fi-6800 and Fujitsu Scanner fi-6400. Thus, each ballot was tabulated three times. Tabulation results for precinct and central scanning solution were then processed into ClearCount, and reports were generated with results for the election. The result reports were confirmed to match the expected results of the voted ballots.

The Functional Examiner used English and Spanish ballots for the test. Each specific hardware and software component were tested for compliance with the required sections of the Election Code.

ClearVote 1.5 is a paper-based system and paper ballots provide a permanent physical record of each vote cast adhering to Section 1101-A, 25 P.S. § 3031.1. Hand-marked paper ballots and ClearAccess marked ballots are printed and tabulated on ClearCast precinct scanner or ClearCount central scanner.

The primary and general election definitions were created using ClearDesign and loaded to polling place devices and central scanners, which provided assurance that the system can perform ballot creation activities. The Functional Examiner successfully added contests including straight party, parties, choices, precincts, districts, ballot styles, referendum questions and retention contests with appropriate candidates and choices. The ClearAccess and ClearCast components of the ClearVote 1.5 successfully permitted votes for "1 of 1," "N of M," and "Question" contests for a standard and ADA voting session. The Functional Examiner also exercised a straight party vote to confirm that all appropriate candidates were selected. The Functional Examiner thus concluded that the system is in compliance with Section 1107-A(2), 25 P.S. § 3031.7(2).

Each of the applicable components of ClearVote 1.5 allowed the test voter to cast a write-in vote and demonstrated compliance with Section 1107-A(5), 25 P.S. § 3031.7(5).

ClearVote 1.5 meets the requirements for Section 1107-A(6), 25 P.S. § 3031.7(6), because the test voters cast votes on different ballot styles for candidates and questions and the ClearAccess displayed only contests for which the voter was entitled to vote.

The system's compliance with Section 1107-A(7), 25 P.S. § 3031.7(7), was demonstrated since ClearCast has the capability to indicate overvotes for any office and the voter has the ability to either spoil the ballot or cast the ballot with overvotes if the voter decides to do so. ClearAccess did not allow overvotes. The Functional Examiner also noted that the system allowed undervotes but warned the user about the undervote when configured to do so.

The successful validation of the election results shows that central scanning solution ClearCount, as well as precinct tabulator ClearAccess, include the capability to reject all choices recorded on the ballot for an office or question if the number of choices exceeds the number for which the voter is entitled to vote, adhering to Section 1107-A(8), 25 P.S. § 3031.7(8).

The ClearVote 1.5 complies with Section 1107-A(9), 25 P.S. § 3031.7(9), because test voters in the closed primary election were only able to vote for referendum questions and candidates seeking the nomination of their party.

Adherence to Section 1107-A(10), 25 P.S. § 3031.7(10), was demonstrated for both ADA and standard voting sessions. ClearAccess allowed the voters to review their ballots before printing for tabulation on precinct scanner ClearCast or central scanning solution ClearCount. The Functional Examiner attempted to change votes on ClearAccess for candidates within the contest, as well as after leaving the contest and then returning to other contests and while reviewing the summary screen. The tests demonstrated that ClearAccess allowed changing the selections until the voter decides to print or cast the ballot. The ClearCast precinct scanner of ClearVote 1.5 provides the voter with a caution message when the ballot contains potential errors, such as the presence of overvotes or undervotes. The voter is presented with a message that explains the error on the screen when the tabulator detects potential errors and the ballot is returned. The voter can either

decide to affirm their intent by casting the ballot, or they can spoil the ballot and fill out another ballot.

Accuracy requirements of 1107-A(11), 25 P.S. § 3031.7(11), that were ascertained by reviewing EAC test reports were further validated by the successful tabulation and validation of the primary and general elections run by the Functional Examiner. The Functional Examiner further validated the system accuracy and performance during the System Accuracy validation phase of testing.

The Functional Examiner validated via test cases during the primary and general election that the tabulating devices ClearCast and ClearCount generated zero proof reports only before ballots were cast, the system rejected all votes for the contest in an overvote situation, and produced a results report when appropriately configured as required under Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17). The Functional Examiner confirmed that the zero-proof report cannot be generated on demand after a ballot is cast.

Ballots were marked by hand including write-in votes during the general election to examine the system's ability to properly enact the PA method. The ClearCast and ClearCount demonstrated compliance with Sections 1107-A(3) and (4), 25 P.S. §§ 3031.7(3) & (4), by appropriately tabulating the votes. The Functional Examiner also validated PA method compliance of the ClearAccess ballot marking device with appropriate test cases.

The voting variations used for the examination included write-in votes to ensure that all components of the system will identify the appropriate write-ins and allow the election official to tabulate all cast votes, including write-in votes. The ClearAccess ballot marking device allowed to include write-in votes. The ClearCast and ClearCount systems identified write-in votes during tabulation. The Functional Examiner noted that the system allowed identifying the write-ins but required the jurisdiction to develop a process to adjudicate the count of write-in votes. The Functional Examiner hence concluded that ClearVote 1.5 complies to Section 1107-A(13), 25 P.S. § 3031.7(13).

4.   Security/Penetration Analysis

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The Functional Examiner performed this portion of the test on ClearVote 1.4.5 and then conducted a follow-up examination on ClearVote 1.5. Functional Examiner adopted a strategy to review each pertinent requirement for this test individually and then created test cases to address it in either a documentation review, a functional test, or both.

Precinct tabulation devices and ballot marking devices were configured for delivery to a polling place from a warehouse including all seals and locks recommended by the manufacturer. The central scanners were configured for operation in a county office. The devices were inspected for the ability to be tampered with. The inspection examined ports, outer case and memory devices to confirm that they are all secure and the locks and seals are tamper proof and evident. The Functional Examiner also examined the components of the ClearVote 1.4.5/1.5 system for password management of administrative functions and ensured that the system counter could not be reset by unauthorized persons. In addition, the Functional Examiner also reviewed "Clear Ballot System Security Specification" document for ballot security procedures at the polling place and central location to ensure that the manufacturer recommended the required steps for configuring the ClearVote 1.4.5/1.5 securely for the election. Based on the tests, the Functional Examiner concluded that that the system complies with Section 1107-A(12), 25 P.S. § 3031.7(12).

The Functional Examiner included test cases during the Security/Penetration analysis phase of the testing to evaluate the security requirements mandated by Sections 1107-A(16) and (17), 25 P.S. §§ 3031.7(16) & (17). The Functional Examiner validated that the tabulation device ClearCount had a visible public counter and the system prevented authorized and unauthorized users any access to vote data while polls are open. Tests were completed to determine that USB ports do not allow any data or information to be transferred to the ClearCast and no maintenance, poll worker or administrative modes allow tampering with the tabulating element. The system did not allow polls to be opened without running a zero-proof report and the content of the report showed that all candidate positions, each question and the public counter were all set to zero. The functionality of the system to generate the close of polls report was verified and the report contents were analyzed to ensure that it contained the total number of ballots tabulated and total number of votes for

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each candidate and question on the ballot. Based on the above tests and the test cases executed while running the elections, the Functional Examiner concluded that ClearVote 1.4.5/1.5complies with all requirements mandated by 25 P.S. §§ 3031.7(16) and (17).

5.   Privacy Analysis

The Functional Examiner performed this portion of the test on ClearVote 1.4.5 and then conducted a follow-up examination on ClearVote 1.5. The Functional Examiner reviewed and inspected the privacy aspects of ClearVote 1.4.5/1.5system to determine compliance with Section 1101-A(1) of the Election Code, 25 P.S. § 3031.7(1). The Functional Examiner determined that the components of the system used at the polling place comply with 25 P.S. § 3031.7(1) by review of system documentation and physical inspection. Central scanners were physically examined by the Functional Examiner for adequate visual secrecy. The Functional Examiner also verified that no voter data, including stored ballot images are tied back to any specific voter in a manner that would compromise voter secrecy.

6.   Usability Analysis

The Functional Examiner performed this portion of the test on ClearVote 1.4.5 and then conducted a follow-up examination on ClearVote 1.5. The Functional Examiner determined that ClearVote 1.5 demonstrated compliance with the usability requirements of Section 1107-A(14) and (15) of the Election Code, 25 P.S. §§ 3031.7(14) & (15), by reviewing appropriate EAC certification reports and from his experience of using all the functionalities of the system during the examination.

7.   System Accuracy Validation

As mentioned in the Examination Process and Procedures section of this report, the Functional Examiner had to halt the examination proceedings at SLI on January 11 thru 15, 2019. Issues were encountered where ballots were flaky and smudgy. During the test ClearCast scanner required intermittent cleaning in order to scan the ballots. The test had to be halted, because blank ovals were being incorrectly read as marked by the ClearCast

precinct scanner. ClearCast precinct scanner and ClearCount central scanner read the same ballot differently and the actual election results did not match expected results. The Department in consultation with EAC and Functional Examiner decided to run a system accuracy validation test by scanning approximately 1000 ballots, for each ballot stock type to be certified for use in Pennsylvania.

A general election consisting of four parties (Republican, Democratic, Green and Libertarian), one precinct and 9 contests (Straight Party, President/Vice President, United States Senator, Governor/Lieutenant Governor, Judge of the Superior Court, School Director, County Commissioner, Election Judge, Retention question) was run utilizing Clear Design, Clear Access, Clear Cast and Clear Count. The Functional Examiner created the election definitions using Clear Design and transport media with was created to populate ClearCast, ClearAccess and ClearCount. Polls were opened and ballots were marked manually, as well as electronically via the Clear Access Ballot Marking Device, then tabulated through the polling place ClearCast scanner. The general election test was completed using two ballot stocks, 60 lb and 65lb. A total of 1000 ballots were scanned for each ballot stock, 500 ballots commercially printed and marked by hand, 250 printed using the OKI 432 printer and marked by hand and 250 marked and printed using hand-marked ballots, and ClearAccess. All ballots created were then tabulated through the ClearCast precinct scanner and ClearCount central scanning solution using Fujitsu fi-6400. Thus, each ballot was tabulated two times. The results were then reconciled against expected results. The tests completed successfully for both ballot stocks and hence the Functional Examiner ascertained that the systems meets the accuracy requirements as required by Section 1107-A(11) and (13), 25 P.S. §§3031.7(11) & 3031.7(13).

ClearVote 1.4.5/ClearVote 1.5 Accessibility Examination

The tests included examiner review, sessions with voters and poll workers. A summary of the test details and findings is discussed in this section.

Examiner Review

The Accessibility Examiner conducted a review of the voting system under examination prior to sessions with voters and poll workers. The Accessibility Examination team included both accessibility and usability expertise to ensure background and knowledge of the issues for accessible voting. The Accessibility Examiner had experience working with people with a wide variety of disabilities and their impact on daily life, knowledge of the range and use of assistive technologies that voters with disabilities might rely on for access, experience conducting usability evaluations with voters, and strong knowledge of best practices and design principles for digital technology and voting systems. The expert review by the Accessibility Examiner gave a chance to make sure they understand how the system and accessibility features work and to note anything that could inform preparation for other testing.

<u>Voter Sessions</u>

The following voter population was represented in the test sessions:

- 2 blind from birth
- 1 with late onset blindness
- 2 with low vision
- 1 with low vision and dexterity limitations
- 1 with mobility limitations

Age Ranges: 35 thru 70.

Counties: Allegheny, Cumberland, Dauphin, and Philadelphia

The voters had a range of voting habits. One blind voter has been a poll worker in his precinct for a number of years. He helps reset the Danaher ELECTronic 1242 for each new voter.

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Poll worker Sessions

Poll workers were invited to come in teams. The Accessibility Examiner had five sessions with poll worker teams for a total of 9 participants. These poll workers:

- represented Dauphin, Lancaster and Perry counties

- Had between five and twenty-six years of experience.

- Had one election commissioner

- Had at least one election judge

- Were experienced with the Danaher ELECTronic 1242, the ES&S iVotronic, and Hart InterCivic ESlate systems

- Had mostly limited experience serving voters with disabilities.

Unique facts about the poll worker groups.

- Two poll workers had blind family members

- One poll worker was blind

The examiner compiled the findings from the examiner review, voter sessions and poll worker sessions into positives, annoyances, problem solving, needs assistance and and likely to prevent independent voting for voters with some disabilities. The Accessibility Examiner included recommendations for improving the accessible voting experience with each of the top five accessibility issues identified. The report also included recommendations on how election officials can support voters and poll workers when the new system is fielded. This section depicts the summarized findings of the top positives and most significant issues identified, and the Accessibility Examiner's analysis and recommendations. Attachment B of this document lists these issues in fuller detail and also describes all the observations from the Accessibility Examination.

The top accessibility issues identified by Accessibility Examiner and voters are summarized in the following section. The Department further evaluated each of the findings

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and recommendations from the Accessibility Examiner and included the appropriate fielding recommendations as conditions for certification of the system[1]. The Department also discussed the findings from the Accessibility testing, specifically the ones that were marked as "Likely to prevent independent voting for voters with some disabilities" to ensure that appropriate fielding recommendations would alleviate the concerns for most voters.

Top Issues

Tactile keypad issues –

- There are two sets of similarly shaped buttons on the tactile keypad, and this confused voters.

- The keypad instructions are too long and detailed, and voters did not show evidence of remembering the basic navigation functions.

- The individual keypad button descriptions could be improved by using shape words first and color words second.

Poor assistive device implementation –

- The sip-and-puff device is not easy to use.

- There is only a USB interface for sip-and-puff assistive device. Although this meets VVSG 1.0, no provision was made for voters to use their own access switches, which would have a standard 3.5mm plug. Voters with certain physical limitations may not be able to vote independently with this machine.

- The USB port [2] and audio jack are not easily accessed because they are behind an aftermarket bezel added to the off-the-shelf touchscreen, and located on the bottom of the machine, with little clearance between the touchscreen and the tabletop.

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[1] Refer to conditions in this report with identification numbers A, Q, R, S, T, U, DD, and EE which relate to the accessibility issues found during the examination findings.
[2] The USB port location was moved to the side of the bezel in the newer hardware.

<u>Write-in process</u>

- The tactile keypad buttons change functions for the write-in screen. Voters found this confusing and had to relearn the new set of instructions.

- Deleting a character from the middle of a word while using the keypad is not possible, though it is possible to delete from the end of an entry, and to change letters in the middle of a name.

- The system does not voice the "space" between first and last names. One voter did not know a space was missing because the name sounded correct.

<u>Paper ballot handling</u>

- Blind voters cannot verify the printed ballot with assistive technology because of the ballot layout.

- Longer ballots may be too big to be secured inside the printer's paper tray and must be placed in the manual feed tray where they hang over the edge. This increases the likelihood that a voter will accidentally knock the paper out of the machine.

- The ballot is printed on both sides like a conventional optical scan ballot, making it difficult for poll workers assisting voters with disabilities to keep their votes private, without some kind of privacy sleeve, which the vendor did not provide.

- There is a delay between when the ballot is inserted and when the scanner feeds it into the machine. If voters let go thinking that it will be accepted immediately, the ballot can fall on the floor. If the voter continues to push the ballot into the scanner until it activates, the risk of jamming increases.

Top Positives

The top positives identified by Accessibility Examiner and voters are summarized below. A full list of the findings for Accessibility Examination is added as Appendix B to this document.

- <u>Test voters could vote privately and independently</u> - The Accessibility Examiner

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noted that generally voters were able to complete their ballot on the system independently, once the facilitator provided them with appropriate accessibility features. However, voters with physical disabilities might not be able to vote privately and independently on this machine with only a sip-and-puff interface. The sip and puff device was not easy to use and the implementation did not allow to attach a dual switch.

- Blind access features were easily learned by voters and poll workers, and poll workers reported the features would help their voters. The report noted that the voters seemed to learn the access features relatively easily. All five poll worker groups reported that the access features would help voters who already visit their location on Election Day.

- Great audio quality and implementation – The Accessibility Examiner felt that the voice quality was great, and voters commented that they also liked the voice. The phrasing was good and followed natural speech patterns In most areas, it sounded natural and there was neither too little nor too much space between words. The Accessibility Examiner noted that ClearBallot implemented the audio features well.

- Helpful contest instructions and selections – The report noted that wording of the contest instructions and selections was good. The report noted that the audio instructions stated how many total options were available and how many additional selections the voter could make. If the voters overrode straight party vote, the numbers would reset and indicate how many additional selections could be made. This way even if deselections were made out of the voter's view, information about the change was provided to the voter.

- Excellent implementation of the straight party method – The Accessibility Examiner noted that ClearAccess system implemented straight party method intuitively. The Examiner noted the following items

  ➢ Use of different colors for pre-marked straight party selections and manual selections

> ➢ Use of audio cues to help voters know if they are focused on a pre-marked selection, confirmed selection, or an unselected candidate.

> ➢ Indication of how many additional selections can be made if any.

> ➢ Counter showing the number of additional selections changes when the voter changes a straight party vote.

- Easy flow through the ballot – The Examiner noted that at each step, the navigation seemed intuitive for all voters. The report noted the following highlights.

> ➢ If a contest has not been voted, the "Next" button becomes "Skip" indicating they could leave a contest blank.

> ➢ Overvote and undervote alerts were worded well and they allowed the voter to proceed or return to voting, rather than completely interrupting the process.

The Accessibility Examiner noted that both voters and poll workers stressed the need for a strong education program to introduce new systems, including opportunities for hands-on training or practice both as a new system is rolled out and at the polling location.

ClearVote 1.5 Security Examination

As mentioned in the Examination Approach section of this document, the test report provided by ClearBallot defined the Security Testing to be comprised of a series of test suites which are utilized for verifying that a voting system will correspond to applicable security requirements within the Pennsylvania Election Code.

Security tests were designed and executed to address election confidentiality, integrity, and availability. When applicable, some reviews were reinforced by equivalent test results that were achieved as part of an EAC certification test campaign.

The tests were done to PA Test Specifications and included requirements for the following security categories:

- Documentation Review

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- Design
- Software Security - Access Control
- Network
- Audit Logging
- Physical Security
- Penetration Testing

This report identified testing to be divided into Security Specification Conformity and Penetration Testing. The report included evidence of conformity and notes from the Pro V&V personnel who performed the tests. The report also provided the risk assessment that was performed on the system to help plan and prioritize penetration testing scenarios.

The test report summarized examiner analysis of the test results and summarized the system security posture, system logging capabilities, capability to support audits and best practices in fielding the equipment.

SLI Compliance, the appointed voting system Examiner for Department of State reviewed the test report to ensure that the system is tested to PA security standards.

The Functional Examiner also noted that the paper ballots will allow statistical recounts as required by Sections 1117-A, 25 P.S. § 3031.17.

ClearVote 1.5 was certified by EAC on March 19, 2019, and hence compiles with Section 1105-A(a) of the Election Code, 25 P.S.§ 3031.5(a), which requires that a voting system must be examined and approved by a federally recognized independent testing authority (ITA), or VSTL as such authorities are now called. The final EAC certification scope is added to this report as Attachment A.

The Functional Examiner identified that the following within Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22. are

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not applicable to the current examination, as each deal with non-functional testing aspects of acquisition, and use and maintenance aspects of a voting system:

- 25 P.S. § 3031.2;
- 25 P.S. § 3031.3;
- 25 P.S. § 3031.4;
- 25 P.S. § 3031.6;
- 25 P.S. § 3031.8;
- 25 P.S. § 3031.9;
- 25 P.S. § 3031.10;
- 25 P.S. § 3031.11;
- 25 P.S. § 3031.12;
- 25 P.S. § 3031.13;
- 25 P.S. § 3031.14;
- 25 P.S. § 3031.15;
- 25 P.S. § 3031.16;
- 25 P.S. § 3031.18;
- 25 P.S. § 3031.19;
- 25 P.S. § 3031.20;
- 25 P.S. § 3031.21; and
- 25 P.S. § 3031.22.

After all the testing activities, the Examiners and Department concluded that the ClearVote 1.5 demonstrates compliance with all requirements as delineated in Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22.

D.   Observations

During the examination, and in the review of documentation, the Examiner and/or Department staff noted the following observations:

1.   ClearVote 1.5 does not support cumulative voting.

2.   ClearVote 1.5 doesn't provide a systematic method for adjudicating write-ins and including the results in the final tabulation reports. The jurisdiction can identify the ballots with write-ins and must implement a process to count the write-in votes for each candidate.

3.   The configuration of the system complying with the Pennsylvania Election Code

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requirements including the PA method will require the use of appropriate selections of configurable parameters.

4.   Observations/Findings identified during the Accessibility Examination identified in Appendix B.

5.   ClearVote 1.5 uses COTS components as printers for the ballot marking devices and as scanning equipment. The OKI 432 printer used as a printer for ClearAccess device is used at the polling place and hence appropriate precautions will need to be taken to ensure that the printer settings are not altered while polls are open.

6.   The system functional testing identified the need to update the system documentation. The following documents were updated by ClearBallot and were validated by the functional examiner.

- ClearAccess Hardware Compliance Addendum 020519
- ClearAccess Installation Guide 021119
- ClearCount Functionality Description 021219
- ClearVote Approved Parts List 020519
- ClearVote Ballot Stock and Printing Specification 021119

7.   ClearVote 1.5 system presented for examination and certification to the Department, displayed cross-endorsed candidates twice on the general election ballot, once with "Republican" party affiliation and once with "Democratic" party affiliation.

8.   The ADA compliant ballot marking device ClearAccess presented as part of the ClearVote 1.5 system, could be effectively used by all voters. This allows jurisdictions to expand the use of these devices for a larger universe of voters and not restrict their use to voters using assistive devices.

9.   ClearAccess ballot marking device produces ballots that look like a hand marked paper ballot. In order for the tabulation logic to accommodate the situation where a voter intentionally deselects all candidates in a contest after voting straight party, the system identifies

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a ballot where the voter has made changes after voting straight party, by adding a diamond mark notation near the straight party contest on the printed ballot.

IV.   Conditions for Certification

Given the results of the examination that occurred in October 2018 and January thru February 2019, and the findings of the Examiners as set forth in his reports, **the Secretary of the Commonwealth certifies the ClearVote 1.5 subject to the following conditions:**

A.   Pennsylvania counties using the ClearVote 1.5 must comply with the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011, and any future revisions or directives. In particular, Pennsylvania counties must adhere to item four (4) of the directive when setting up and positioning the ClearAccess in the polling place to assure compliance with the constitutional and statutory requirements that secrecy in voting be preserved *(see* Pa. Const Art. VII § 4; and Section 1107-A(l) of the Election Code, 25 P.S. § 3031.7(1)).

B.   No components of the ClearVote 1.5 voting system shall be connected to any modem or network interface, including the Internet, at any time, except when a standalone local area wired network configuration in which all connected devices are certified voting system components. Transmission of unofficial results can be accomplished by writing results to media, and moving the media to a different computer that may be connected to a network. Any wireless access points in the district components of ClearVote 1.5, including wireless LAN cards, network adapters, etc. must be uninstalled or disabled prior to delivery or upon delivery of the voting equipment to a county board of elections.

C.   Because ClearVote 1.5 is a paper-based system, counties using the ClearVote 1.5 must comply at a minimum with Section 1117-A of the Election Code, 25 P.S. § 3031.17, that requires a "statistical recount of a random sample of ballots after each election using manual, mechanical or electronic devices of a type different than those used for the specific election." This audit must be conducted via a manual count of the voter marked

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paper ballots exclusively. Counties must include in the sample ballots such samples as may be marked by ADA compliant components. Counties are advised to consult the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011 and any future revisions or directives that may apply to audits of electronic voting systems.

D.   ClearBallot must ensure that the COTS printer used for ClearAccess must be configured to ensure that the printer settings cannot be changed by the voter at the polling place. The configuration must ensure that the printer settings can only be modified by authorized personnel.

E.   ClearVote 1.5 implementations in Pennsylvania must use only 60lb and 65lb paper stock for Elections. This is to ensure that only paper stock that has been tested and validated is used on Election Day. Clear Ballot must work with jurisdictions to ensure that the printer and scanner settings adhere to the identified values in TDP. Clear Ballot and jurisdictions must report to the Department any ballot printing smearing and flaking issues that is noticed during acceptance testing and/or L&A testing. ClearBallot must work with Department of State and the jurisdictions to add training sessions during implementation to ensure that the quality of ballots are maintained while handling, before during and after Elections.

F.   All jurisdictions implementing the ClearVote 1.5 need to carry out a full Logic and Accuracy test on each device without fail and maintain evidence of Logic and Accuracy (L&A) testing in accordance with the statutory requirements for pre-election and post-election testing. The Department does not recommend automated L&A testing and discourages the use of preprinted ballots provided by vendors. All components being used on election day, including accessible devices and any Electronic Poll Books being used, must be part of the L&A testing. Counties must ensure that the L&A test cases include all applicable scenarios of PA straight party method identified in Attachment C to the Directive for electronic voting systems published by BCEL on September 11, 2017.

G.   ClearVote 1.5 is a paper-based system, and hence, implementation of the

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system for precinct or central count scanning is scalable. Jurisdictions should calculate the number of voting booths necessary to accommodate the number of registered voters in a precinct to avoid long lines. Jurisdictions must include the ClearAccess as an ADA compliant device in configuring a precinct polling place. Jurisdictions must also take into consideration the ballot box capacities on polling place components when deciding on the number of voting booths.

H.   All jurisdictions implementing the ClearVote 1.5 must implement administrative safeguards and proper chain of custody to facilitate the safety and security of electronic systems pursuant to the Guidance on electronic Voting System Preparation and Security, September 2016.

I.   Jurisdictions implementing the ClearVote 1.5 with the Central Count Tabulator as the primary system where votes are counted only at the central counting location using central scanners, must comply with Section 301(a) of Help America Vote Act of 2002. The mandate requires counties using central count paper-based systems to develop voting system specific voter education programs that inform voters of the effect of over voting, and instruct voters on how to correct a ballot before it is cast, including instructions on obtaining a replacement ballot. Additionally, the mandate requires that the central count voting system must be designed to preserve voter confidentiality.

J.   All jurisdictions implementing the ClearVote 1.5 must ensure that no default passwords are used on any devices and that all passwords are complex and secured. Counties must implement an audit process to review and ensure that no default passwords are used upon equipment install/reinstall and routinely change passwords (at least once prior to preparing for each primary and election) to avoid any password compromise. The passwords and permissions management must at a minimum comply to the password requirements outlined in NIST 800-63. This publication can be accessed at https://pages.nist.gov/800-63-3/sp800-63-3.html

K.   All jurisdictions implementing ClearVote 1.5 must configure the polling place components of the voting system to notify voters when they attempt to cast overvotes. This is to ensure that the system implementation adheres to the requirement of notifying the voter of

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overvotes as mandated by 25 P.S. § 3031.7(16).

L.   All jurisdictions implementing ClearVote 1.5 must work with Clear Ballot to ensure that only the certified system configuration is installed on purchase or anytime a system component is replaced or upgraded. Jurisdictions must as part of their user acceptance test verify the implementation to ensure that the components, software and firmware belong to the certified system. Jurisdictions must also perform a trusted build validation as part of the election preparation activities and post-election canvass activities utilizing the vendor supplied methods of validation and verification of voting system integrity. A sample format that can be used for the attestation is added Attachment C to this document.

M.   "ClearAudit," identified as a system component per the TDP, is not certified for use in Pennsylvania with ClearVote 1.5. This software was not presented to the Secretary for certification by Clear Ballot.

N.   Jurisdictions must incorporate a process to adjudicate and tabulate write-ins since the system doesn't include a functionality for adding write-in candidates to the system and tallying their votes. Jurisdictions can use the software functionality to evaluate questionable ballots, contests or selections to determine voter intent. Any decisions made during review of the ballot must be agreed upon by a team of at least two reviewers authorized by the election official. The election official can also consult the paper ballot to assist with determinations made during adjudication. Jurisdictions must always consider the voter verified paper ballot as the ballot of record and in the event of a recount, the voter verified paper ballots must be used for the count.

O.   Jurisdictions implementing ClearVote 1.5 must work with ClearBallot to ensure that the implemented configuration is capable of operating for a period of at least two hours on backup power as required by the VVSG. If the system components don't include internal battery packs for reliable power, the Uninterruptible Power Supply (UPS) specified in the EAC certified configuration must be purchased and used at the polling places.

P.   Jurisdictions using the services of ClearBallot or a third-party vendor for

election preparation activities must work with Clear Ballot or the vendor to ensure that systems used for ballot definition activities are considered part of the voting system and use certified voting system components. The systems used for ballot definition must be configured securely following conditions outlined in this report and following any Directives and Guidance issued by the Secretary. Any data transfer between the vendor and county must be done using encrypted physical media or secure file transfer process. The file transfer and download must be tracked and audited to make sure that data has not been accessed by unauthorized personnel.

Q.   Jurisdictions must work with ClearBallot to make sure that sip-and-puff device is calibrated, and the device works for completing a ballot marking session. Jurisdictions must use it during L&A testing to complete a ballot. The jurisdictions implementing ClearVote 1.5 system must hold voter education sessions specifically addressed to voters using accessible devices including sip-and-puff and must clearly communicate the unavailability of the dual switches and allow enough sessions for the voters to get used to the sip-and-puff device for use on Election Day.

R.   Jurisdictions implementing ClearVote 1.5 must implement the use of privacy sleeves to be used by voters carrying marked ballots between the ClearAccess ballot marking device and ClearCast precinct scanner. Poll worker training must emphasize the need for helping voters without violating their privacy. This must include but not be limited to having standard instructions for poll workers to use to guide a voter in casting their own ballot, or narrating the poll worker's actions, so that the voter understands what the poll worker is doing.

S.   ClearAccess printer allows the ballot stock to be secured inside the printer tray, if it is less than 22 inches long. If the ballots are longer than 22 inches, ample care must be taken to make sure that the voter education materials instruct voters on how to insert ballot stock into the printer. Poll worker training must include sessions on identifying issues surrounding the insertion of the ballot and getting the print outs, without violating the privacy of the voter.

T.   The USB port used for attaching the sip-and-puff device must be sealed with a tamper evident seal and must be opened for any session needed and resealed back. Poll worker training must include details around how to manage the device securely during Election Day.

U.   Jurisdictions must work with ClearBallot to thoroughly test and review the audio ballot instructions to ensure that the voters using an audio ballot can cast the ballot without requesting assistance.

V.   Jurisdictions must make voters aware that voting straight party is optional via clear instructions on paper, on screen and on audio ballots. This is to ensure that the voter doesn't assume that he/she must make a selection for the straight party contest. The ballot instructions must be approved by the Department and follow any directives and/or guidance issued by the Department.

W.   The electronic voting system must be physically secured while in transit, storage, or while in use at their respective locations. Unmonitored physical access to devices can lead to compromise, tampering, and/or planned attacks.

X.   Jurisdictions must implement processes and procedures involving management, monitoring and verification of seals, locks/keys, before, during and after the election.

Y.   Jurisdictions must seal any unused ports on the voting system components using tamper evident seals even if the port is inside a locked compartment. Jurisdictions must work with Clear Ballot and use physical port blocking plugs to close unused ports whenever possible before placing the tamper evident seal. The Department also recommends using port blocking plugs for exposed ports for all components of the voting system housed in county office that can be removed by authorized personnel when the port is needed.

Z.   Jurisdictions must protect installations of the EMS server on portable devices must protect the laptops to prevent lost or stolen device.

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AA.   Jurisdictions must implement processes to gather and safekeep system logs for each component of the voting system after each election. Consistent auditing of system logs and reports is vital to maintain system transparency and to ensure that any compromise or malfunction is observed and reported in a timely manner.

BB.   Jurisdictions implementing ClearVote 1.5must ensure that the USB devices and any other removable media used for election activities is maintained with strict chain of custody. There must be a process to manage the removable media inventory to avoid misplaced and lost media. The devices must be reformatted before use in each election. Appropriate steps must be taken to ensure that the format is a full reformat of the USB devices.

CC.   Jurisdictions implementing ClearVote 1.5 must work with ClearBallot to ensure appropriate levels of training for election officials is planned on implementation. Counties must ensure that the trainings adhere to the "Minimum Training Requirements" specified in Attachment D of this document.

DD.   Jurisdictions implementing ClearVote 1.5 must include voter and poll worker training as part of the implementation plan. The training must include hands on practice for both voters and poll workers. Specific consideration must be given to voters using assistive devices and also poll worker education to assist voters with disabilities. Refer to Appendix B, listing detailed recommendations for training during deployment noted by the Accessibility Examiner.

EE.   Jurisdictions implementing ClearVote 1.5must consider the following during voting booth set up for serving voters requiring assistive devices

   o   Voters with disabilities may have assistive technology that they use in their daily life which may need to be brought to the polling place. These technology/devices must be allowed at the polling place. The voting booth set up must account for the requirements to keep the assistive technology or personal notes that they need to place within reach. They may also need room

to place the printed ballot on a flat surface to use personal technology such as magnifiers or text readers to verify it.

o   The path to the ClearCast precinct scanner should be as easy as possible, ideally a straight line with no obstructions. The path should include ample room to turn a wheelchair if the machine is positioned with the screen facing the wall. The ADA standards suggest a minimum of 60x60 inches for this.

Refer to Appendix B, listing detailed recommendations for deployment noted by the Accessibility Examiner.

FF.   Clear Ballot must submit the following system education materials to the Department of State and must consent to the publication and use of the video on any websites hosted by any Pennsylvania counties and the Pennsylvania Secretary of the Commonwealth or publicly available social media platform. The videos must be closed captioned for the visually impaired.

o   A video (in an electronic format) for voters that demonstrates how to cast a vote and ballot using the Voting System.

o   A video (in an electronic format) for precinct election officials that demonstrates how to setup, operate, and shutdown the Voting System components on an Election Day. The video must demonstrate how to set up and operate the voting system accessible devices for use by voters.

o   A "quick reference guide" for precinct election officials to consult on Election Day. The guide must be specific to the purchasing county's setup and use of the Voting System including accessible options.

o   A "quick reference guide" with images that demonstrates to voters how to cast a vote. Must be provided in additional languages for any jurisdictions required to meet thresholds in the Voting Rights Act.

GG.   Clear Ballot must adhere to the following reporting requirements and submit

the following to the Secretary:

- o   Equipment Reporting. Reported field issues or anomalies that occur in
      Pennsylvania or elsewhere with any piece of equipment deployed in the
      Commonwealth of Pennsylvania within 3 days of the occurrence;

- o   Advisory Notices. System advisory notices issued for any piece of equipment
      deployed in the Commonwealth of Pennsylvania regardless of whether the
      incident behind the notice occurred in Pennsylvania;

- o   Ownership, Financing, Employees, Hosting Location. Any changes to
      information on the Supplier's employees and affiliates, locations, company
      size and ability to provide technical support simultaneously to several
      counties in the Commonwealth of Pennsylvania and other jurisdictions that
      use its Voting System. Additionally, Clear Ballot must provide information on
      foreign ownership/financing, data hosting, and production for any equipment
      or ancillary products, including any potential conflict of interest that may have
      developed for employees and affiliates;

- o   Security Measures and any updated security testing or risk/vulnerability
      assessments conducted by the Supplier or a third-party;

- o   SOC 2 Reporting – Clear Ballot shall provide the Secretary with its annual
      American Institute of Certified Public Accountants (AICPA) Attestation
      Standard (AT) Sec. 101 Service Organization Control ("SOC") 2, Type 2
      certification (AT Sec. 101 SOC 2, Type 2), or an equivalent certification
      approved by the Commonwealth. Equivalent certifications include, but are not
      limited to: International Organization of Standards (ISO) 2700x certification;
      certification under the Federal Information Security Management Act
      (FISMA); and AT Sec. 101 SOC 3 (SysTrust/WebTrust) certification.

HH.   Clear Ballot must adhere to the "Source Code and Escrow Items Obligations"

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specified in Attachemnt E of this document.

II. Clear Ballot must work with jurisdictions to ensure that the system is configured to comply with all applicable requirements of the Pennsylvania Election Code delineated in Section Article XI-A of the Pennsylvania Election Code, Sections 1101-A to 1122-A, 25 P.S. §§ 3031.1 – 3031.22.

JJ. Jurisdictions implementing the ClearVote 1.5 and Clear Ballot must work together to implement the system under this certification and must comply with the conditions found in this report, and any directives issued by the Secretary of the Commonwealth regarding the use of this System, in accordance with Section 1105-A(a)-(b) of the Election Code, 25 P.S. § 303l.5(a)-(b). Clear Ballot must ensure that future releases of the voting system with enhanced security and accessibility features are presented for approval to the Secretary.

KK. In addition, pursuant to the Directive on Electronic Voting Systems issued by the Secretary of the Commonwealth on August 8, 2006, the Directive Concerning the Use, Implementation and Operation of Electronic Voting Systems by the County Boards of Elections issued on June 9, 2011 and Section 1105-A(d) of the Pennsylvania Election Code, 25 P.S. § 3031.5(d), this certification and approval is valid only for ClearVote 1.5. If the vendor or a County Board of Elections makes any changes to the ClearVote 1.5 voting system subsequent to the date of its examination, it must immediately notify both the Pennsylvania Department of State and the relevant federal testing authority or laboratory, or their successors. Failure to do so may result in the decertification of the ClearVote 1.5 voting system in the Commonwealth of Pennsylvania.

LL. Jurisdictions implementing ClearVote 1.5 must be aware of the reasons for diamond notation on the ballot printed from the ClearAccess ballot marking device. Jurisdictions must also educate poll workers about the notation on the ballot, so that they can answer any voter questions. Emphasis has to be given during the poll worker training to answer any such voter questions without violating the privacy of

the voter. Jurisdictions must work with ClearBallot to add this in any of their poll worker and voter training manuals before implementation.

V.   Recommendations

A. All jurisdictions implementing ClearVote 1.5 voting System should ensure that the system is correctly set up pursuant to all the recommendations of the Directive Concerning the Use, Implementation and Operations of Electronic Voting Systems by the County Boards of Elections issued by the Secretary of the Commonwealth on June 9, 2011 and Guidance on Electronic Voting System Preparation and Security, September 2016.

B. All jurisdictions implementing ClearVote 1.5should take appropriate steps to ensure that voter education is part of the implementation plan.

C. All jurisdictions implementing the ClearVote 1.5 should ensure that precinct election officials and poll workers receive appropriate training and are comfortable using the system.

D. All jurisdictions considering purchase of the ClearVote 1.5should review the System Limits as mentioned in the EAC certification scope added as Attachment A to this report.

E. The Secretary recommends that Clear Ballot and counties work with the Department on any changes to their voting equipment including, but not limited to, purchase and upgrades.

F. Secretary recommends in-house ballot definition activities at a county location whenever possible. If an external vendor location is used, the county should implement oversight measures to ensure that election data including ballot definition files and audit logs stored on devices outside of the county are protected from unauthorized access.

G. The Secretary recommends that ClearBallot present a newer version for state certification before the general election, to ensure that the system in use for the general

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election will have the cross endorsed candidates listed only once on the ballot, which is the preferred approach.

VI.   Conclusion

As a result of the examination, and after consultation with the Department's staff, counsel and the examiners, the Secretary of the Commonwealth concludes that the ClearVote 1.5 can be safely used by voters at elections as provided in the Pennsylvania Election Code and meets all of the requirements set forth in the Election Code, **provided the voting system is implemented under the conditions listed in Section IV of this report**. Accordingly, the Secretary certifies ClearVote 1.5 for use in this Commonwealth.

The ClearAccess ballot marking device can accommodate 10-12 voters with disabilities an hour or 20-60 voters an hour when used as the primary voting system depending on size of the ballot. ClearCast precinct scanner can serve 45-60 voters per hour. The ClearCount system performance and speed depends on the COTS scanner used as part of the system. ClearBallot system documentation suggests that both Fujitsu fi-6400 and fi-6800 can support large jurisdictions that has more than 100,000 voters.